

JPL Publication 96-2

# Venus Gravity Handbook

Alexander S. Konopliv  
William L. Sjogren

January 1996



National Aeronautics and  
Space Administration

**Jet Propulsion Laboratory**  
California Institute of Technology  
Pasadena, California



The research described in this publication was carried out by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not constitute or imply its endorsement by the United States Government or the Jet Propulsion Laboratory, California Institute of Technology.





## **Abstract**

This report documents the Venus gravity methods and results to date (model MGNP90LSAAP). It is called a handbook in that it contains many useful plots (such as geometry and orbit behavior) that are useful in evaluating the tracking data. We discuss the models that are used in processing the Doppler data and the estimation method for determining the gravity field. With Pioneer Venus Orbiter and Magellan tracking data, the Venus gravity field was determined complete to degree and order 90 with the use of the JPL Cray T3D Supercomputer. The gravity field shows unprecedented high correlation with topography and resolution of features to the 200km resolution. In the procedure for solving the gravity field, other information is gained as well, and, for example, we discuss results for the Venus ephemeris, Love number, pole orientation of Venus, and atmospheric densities. Of significance is the Love number solution which indicates a liquid core for Venus. The ephemeris of Venus is determined to an accuracy of 0.02 mm/s (tens of meters in position), and the rotation period to  $243.0194 \pm 0.0002$  days.

### **Acknowledgements**

We thank Chuck Yoder for his input on the Love number determination, Myles Standish for work with the Venus ephemeris, Nicole Rappaport for the Venus topography model, Connie Dang and Herb Royden for their special efforts in delivering the ionospheric and tropospheric calibrations used in this work, Fred Krogh for help with the numerical integration, and Algis Kucinskas for discussions on the geophysics of Venus. The supercomputing development was funded by a 1995 JPL Director's Discretionary Fund proposal. Special thanks are due Chuck Lawson and Jon Giorgini for their efforts in developing the gravity software for the Cray. The JPL MGSO provided funds to finish and document the task (this report). The Cray Supercomputer used in this investigation was provided by funding from the NASA Offices of Mission to Planet Earth, Aeronautics, and Space Science.

## Table of Contents

Abstract .....	iii
Acknowledgements.....	iv
Table of Contents .....	v
List of Figures .....	vii
List of Tables .....	ix
1. Introduction .....	1
2. Spacecraft Tracking .....	2
3. Models .....	5
a. Observable .....	6
b. Geometric Models .....	7
c. Dynamic Models .....	10
4. Estimation Procedure .....	16
a. Determination of Unconstrained Gravity Field .....	16
b. Gravity A Priori.....	17
5. Gravity Results .....	23
a. Global Gravity Model .....	23
b. Principal Axes .....	48
c. Love Number.....	50
6. Venus Constants .....	51
a. Venus Ephemeris .....	51
b. Venus Pole and Rotation .....	54

7. Solutions for Auxiliary Forces .....	55
a. Atmospheric Drag .....	55
b. Solar Pressure .....	59
8. Summary .....	60
References .....	61
Appendix A: PVO Low-Altitude Periapse Information .....	A-1
Appendix B: PVO High-Altitude Periapse Information .....	B-1
Appendix C: Magellan Cycle 4 (Elliptical) Information .....	C-1
Appendix D: Magellan Cycle 5 and 6 (Circular) Information .....	D-1
Appendix E: Magellan X-Band Orbit Information .....	E-1
Appendix F: PVO and Magellan Data Arcs .....	F-1
Appendix G: MGNP90LSAAP Gravity Coefficients to Degree and Order 40 ...	G-1
Appendix H: Correlations Between Estimated Parameters .....	H-1
Appendix I: Regional Gravity Maps for MGNP90LSAAP.....	I-1

## List of Figures

1.	Space91 and Texas UT1 Daily Differences .....	9
2.	Space91 and Texas X-Pole Daily Differences .....	9
3.	Space91 and Texas Y-Pole Daily Differences .....	9
4.	Daily Solar Flux for PVO and Magellan Time Frame .....	10
5.	Radial Acceleration Profile for High-Altitude PVO .....	15
6.	Radial Acceleration Profile for Low-Altitude PVO .....	15
7.	Radial Acceleration Profile for Magellan Cycle 4 .....	15
8.	Radial Acceleration Profile for Magellan Cycle 5&6 .....	15
9.	Acceleration Profiles for Venus Unconstrained Surface Gravity .....	19
10.	Degree Strength for MGNP90LSAAP .....	20
11.	Acceleration Profiles for Venus Constrained Surface Gravity .....	22
12.	Gravity Correlation with Topography of Surface Constraint Minus Kaula Constraint .....	22
13.	Vertical Gravity of Venus at the Surface (mgals) .....	25
14.	Geoid of Venus (meters) .....	26
15.	Vertical Gravity Uncertainty at the Surface (mgals) .....	27
16.	Venus Geoid Uncertainty (meters) .....	28
17.	Vertical Gravity Error to the Degree Strength .....	30
18.	Unconstrained Vertical Gravity (mgals), Degree=90 .....	31
19.	Unconstrained Vertical Gravity (mgals), Degree=75 .....	32
20.	Unconstrained Vertical Gravity (mgals), Degree=60 .....	33
21.	Unconstrained Vertical Gravity (mgals), Degree=40 .....	34
22.	RMS Magnitude Gravity Spectrum .....	37
23.	Correlation of Gravity with Topography and Error Bars .....	37
24.	Comparison of Correlation with Topography for Gravity Solutions .....	37

25.	Correlation with Topography for N=2 to 10 .....	38
26.	Correlation with Topography for N=11 to 20 .....	39
27.	Correlation with Topography for N=21 to 30 .....	40
28.	Correlation with Topography for N=61 to 90 .....	41
29.	MGNP90LSAAP Admittance and Theoretical Compensation Depths .....	42
30.	Apparent Depth of Compensation for N=41 to 60 .....	44
31.	Bouguer Gravity for MGNP90LSAAP .....	45
32.	Isostatic Perturbations for MGNP90LSAAP .....	46
33.	Isostatic Anomaly Map for Mead Crater .....	47
34.	Gravity Coefficient Correlation Matrix .....	48
35.	Ephemeris Solution for PVO wrt DE403 .....	52
36.	Ephemeris Solution for Magellan Cycle 4 wrt DE403 .....	52
37.	Ephemeris Solution for Magellan Cycle 5&6 wrt DE403 .....	52
38.	Venus wrt Earth Radial Position Error .....	54
39.	PVO Low-Orbit Density Solution at 140 km Altitude .....	56
40.	Difference of PVO Density Solutions and VIRA Values at Spacecraft Altitude .....	56
41.	PVO Low-Orbit Atmospheric Lift Solution .....	56
42.	PVO Low-Orbit Solar Radiation Pressure (GR) Solution .....	57
43.	PVO Low-Orbit Solar Radiation Pressure (GX) Solution .....	57
44.	PVO Low-Orbit Solar Radiation Pressure (GY) Solution .....	57
45.	PVO High-Orbit Solar Radiation Pressure (GR) Solution .....	58
46.	PVO High-Orbit Solar Radiation Pressure (GX) Solution .....	58
47.	PVO High-Orbit Solar Radiation Pressure (GY) Solution .....	58

## List of Tables

1.	Tracking Station Cylindrical Coordinates .....	7
2.	DSN Plate Motion Velocities in cm/year .....	7
3.	VIRA Atmosphere Model .....	13
4.	Gravitational Constant Times the Mass of Venus (GM in $\text{km}^3/\text{s}^2$ ).....	24
5.	Gravity Peaks for Venusian Features of Interest .....	29
6.	Comparisons of Spherical Harmonics with Line-of-Sight Reductions (mgals) .....	35
7.	Principal Axes for Venus in Degrees .....	49
8.	Normalized Second Degree Coefficients with Formal Uncertainties ( $\times 10^{10}$ ) .....	50
9.	Love Number Solutions.....	51
10.	Venus and Earth Ephemeris Solutions ( $\times 10^9$ ) .....	53
11.	Venus Pole and Rotation Rate Solutions .....	55





## 1. Introduction

Two spacecraft orbiters, Magellan and Pioneer Venus Orbiter (Pioneer 12 or PVO), provide nearly a global gravity data set for Venus. Together they have been used to solve for a 90th degree and order spherical harmonic gravity field of Venus as well as the GM of Venus (gravitational constant times the mass), ephemeris of Venus with respect to the Earth, tide or Love number ( $k_2$ ) of Venus, pole and rotation rate of Venus, and other addition models such as atmospheric densities and Venus albedo variations. This handbook documents the data used in the reduction and presents the results to date.

Prior to Magellan and PVO, the Mariner 2, 5, and 10 flybys of Venus provided mass estimates and an upper bound on  $J_2$  (Anderson and Efron, 1969 and Howard et al, 1974) showing that the oblateness for Venus was several orders of magnitude smaller than the Earth's oblateness. The Russian Venera 9 and 10 spacecraft provided a more accurate estimate of  $J_2 = 4.0 \pm 1.5 \times 10^{-6}$  (Akim et al, 1978). The initial spherical harmonic determinations of the Venus gravity field from PVO were low degree and order solutions by Ananda et al (1980) to degree and order six and Williams et al (1983) to degree and order seven. Mottinger et al (1985) extended the harmonic solution to degree and order ten by using only high-altitude periapse (about 1000 km) data from PVO, and Bills et al (1987) solved for a degree and order 18 field by combining the high-altitude data with low-altitude data arcs. In addition to harmonic analyses, others such as Phillips et al (1979), Sjogren et al (1980, 1983, 1984), Reasenberg et al (1981, 1982), and more recently Reasenberg and Goldberg (1992) have solved for high resolution surface mass distributions either regionally or globally.

With the arrival of faster computers with more memory and disk space, the spherical harmonic solutions have shown a drastic increase in resolution. In support of the Magellan Navigation effort, McNamee et al (1992) reprocessed the low-altitude PVO data to produce a 21st degree and order model. Nerem (1991) with the additional high-altitude PVO data set produced the Preliminary Goddard Venus Model 1, a 36th degree and order field, and ushered in dramatic increases in resolution for harmonic fields. Konopliv (1992) followed with a 42nd degree and order field and Nerem et al (1993) with a 50th degree and order field, all based upon PVO low- and high-altitude data sets.

With Magellan now in orbit, McNamee et al (1993) produced another 21st degree and order field incorporating Magellan high-altitude (periapse altitude of 250 km) data with PVO. After September 1992, Magellan began to be tracked during periapse (altitude of 170 km). Prior to this, the high gain antenna was pointed toward Venus to acquire Synthetic Aperture Radar (SAR) images and no Doppler tracking was obtained within 30 minutes of periapse. Konopliv et al (1993a) produced a 60th degree and order model by combining the PVO data with four months (or about one-half of longitude coverage) of Magellan data. After Magellan successfully aerobraked into a near circular orbit in August of 1993, Konopliv and Sjogren (1994a) produced another 60th degree and order model incorporating much of the near circular orbit data, and Konopliv et al (1994b) produced a 75th degree and order model with all the Magellan gravity data. This report presents the results for a 90th degree and order gravity solution (named MGNP90LSAAP). This model is the highest resolution spherical harmonic model for a planet, including the Earth, that is based upon spacecraft tracking data. The current solutions for the Earth gravity field extend

to degree and order 70 for solutions based upon spacecraft tracking data only (Nerem et al, 1994) and to degree and order 360 with surface measurements included (Rapp et al, 1991). Nerem et al (1995) summarize the history of gravity determination.

In addition to the spherical harmonic gravity field, line-of-sight (LOS) accelerations with respect to a spherical harmonic gravity field (degree and order 75, JPL solution MGNP75ISAAP, for the pre-aerobraking data and degree and order 40, JPL gravity solution MGN40E, for the post-aerobraking data) have been produced for the Magellan Doppler residuals. The procedure is to solve for the spacecraft state and other spacecraft specific dynamical models using the base spherical harmonic model. The residuals then contain the remaining gravity signature in the data that is not incorporated into the harmonic field. Orbits are processed one at a time, and so this eliminates long-term modeling errors (and long-term gravity information). The pre-aerobraking LOS data were processed by Barriot and Balmino (1994) to produce detailed gravity maps over Eistla Regio and the western portion of Aphrodite Terra. Kaula (1995), Smrekar (1994), and others have produced regional gravity determinations from the LOS data as well.

## **2. Spacecraft Tracking**

The gravity measurements used for Venus gravity field determination are two-way coherent Doppler tracking of the PVO and Magellan spacecraft acquired at the Deep Space Network (DSN) complexes at Goldstone, California; Madrid, Spain; and Canberra, Australia. The PVO spacecraft operated at S-band with the DSN stations transmitting at 2.11 GHz. The transponder on board the spacecraft then multiplied the frequency by 240/221 to obtain a downlink frequency of 2.30 GHz. For PVO, only two-way data were acquired, i.e., the receiving DSN station is the same as the transmitting station. The spacecraft transponder also provided a minimal amount of X-band downlink data (S-band and X-band were received simultaneously at the ground station), but these data were not processed. The Magellan spacecraft had an S-band transponder with an X to S-band uplink converter and S to X-band downlink converter. The resulting system had either an X-band or S-band uplink and an S-band and/or X-band downlink. The X-band uplink and X-band downlink (8.43 GHz) provided the high resolution gravity data because of reduced charged particle effects on the X-band signal. All two-way Magellan data were processed beginning with the gravity data of cycle four. Three-way data (i.e., the receiving DSN complex is different from the transmitting complex) were also taken for generation of differenced Doppler data in support of navigation, but these data were not incorporated into the gravity solution.

PVO was inserted into orbit about Venus on December 4, 1978 and provided several years of low-altitude periapse data (150 to 170 km) until July of 1980 when no maneuvers were performed to maintain a low periapse altitude. By November of 1980, periapse altitude reached 400 km due to solar perturbations on the orbit. The low-altitude data set is continuous from December 9, 1978 to December 4, 1980 except for a data gap from July 12, 1979 to December 18, 1979, during which superior conjunction occurred and periapse was occulted, and so these data will not add much to the gravity solution. Tracking data were acquired during this time, but these data have not been recovered from archive tapes and may or may not exist. Due to the superior resolution of the Magellan data, the PVO data were compressed substantially to 60 seconds for the interval within thirty

minutes each side of periapse, 300 seconds for the next two hours around periapse, and 600 seconds near apoapse. The spacecraft velocity at periapse is 9 km/s and 60 second samples decrease the periapse resolution in the PVO data, but this is easily recovered with the Magellan data and the three to four longitudinal coverages of the PVO data. This compression time still retains the long term gravity, rotational, tidal, and ephemeris information and greatly reduces computer time required for filtering. Future solutions may reintroduce a higher number of samples at periapse. The original PVO data, as processed by Konopliv et al (1993a) and others have 5 second samples at periapse. The total number of Doppler observations processed for the low-altitude PVO data is 170,000.

The time histories of the low-altitude orbit semi-major axis, eccentricity, inclination, latitude at periapse, longitude at periapse, altitude at periapse, plane-of-sky inclination, one-way light time, Sun-Earth-Venus angle, Earth-Venus-Probe at periapse angle, and local solar time at periapse are given in Appendix A. PVO had a highly eccentric ( $e=0.8$ ) orbit with a period of 24 hours and was nearly polar with an inclination of  $106^\circ$ . Because of the high eccentricity, the altitude climbed to over 1000 km for the high latitude regions ( $>60^\circ\text{N}$ ,  $<30^\circ\text{S}$ ) as shown by the altitude profile in Appendix A. The approximately weekly maneuvers to lower periapse altitude are clearly evident in the semi-major axis, eccentricity, and periapse altitude plots. The geometry of the orbit provides good gravity data since the plane-of-sky inclination (angle between line-of-sight and orbit plane normal) rarely fell below  $20^\circ$  to near face-on geometries. Initially, periapse was occulted and became visible in March of 1979. Also, as periapse rose at the end of the low-altitude data set, periapse became occulted again (as shown by the Earth-Venus-Probe at periapse angle plot in Appendix A). Since the rotational period of Venus is 243 days, the low-altitude data provide several longitudinal coverages of Venus with the high resolution data contained within a narrow latitude band around periapse. The low-altitude data set, with the exception of the first three months of data to March 1979, is identical to the data set used by McNamee et al (1993) and Nerem et al (1993).

The second PVO data set extends from November 6, 1981 to September 7, 1982. During this time, periapse increased from 980 km to 1340 km due to the solar perturbation. At the beginning of this time span, periapse was just coming out of occultation, and near the end of the high-altitude data, periapse again entered occultation in August of 1982. After 1982, periapse altitude increased unimpeded until its maximum of about 2500 km in 1986 and then it decreased until 1992. At that time, periapse raise maneuvers were performed to keep PVO from burning up in the atmosphere. However, with propellant exhausted, PVO entered too deep into the atmosphere and the DSN lost signal on Oct. 8, 1992. This data set, due to sparseness of tracking, is not included in this gravity solution. Again, future studies may include this tracking. The high-altitude PVO was tracked continuously for three days once a week for this part of the mission (Mottinger et al, 1985), and amounts to 34,000 observations with the same compression scheme as the low-altitude PVO data. This data set is identical to the high-altitude data set used by Mottinger et al (1985) and is included in the solution by Nerem et al (1993).

Appendix B shows the high PVO orbit time histories of the same variables as the low-altitude orbit (Appendix A). The nearly conservative behavior of the orbit (due to minimal atmospheric drag) is shown by the periodic motion of the osculating semi-major axis. Since drag is small, the solar pressure force and Venus albedo forces have the major effect on the Venus orbit. For this reason, the Earth-Venus-Sun angle is also given in

Appendix B to show the angle of the PVO antenna with respect to the Venus-Sun line. With ten months of data, the high-altitude orbit provides more than one full longitudinal coverage of Venus. However, the first four months of the high-altitude data were in a nearly face-on geometry.

The Magellan spacecraft was inserted into orbit about Venus on August 10, 1990. The first three cycles (one cycle is one Venus rotation period of 243 days) were dedicated to SAR imaging of the Venus surface. This required the high gain antenna to be pointed to the Venus surface within about thirty minutes of periapse passage. Thus only high-altitude tracking ( $>2500$  km) was obtained when the high gain antenna was returned to point at Earth. These data still, however, have some long term information on the gravity field and it was used by McNamee et al (1993). The altitude of periapse for the first three cycles is 250 km and is higher than the gravity cycle four. Except for the periapse altitude, the orbit shape for cycle four is identical to the previous cycles and should contain all the gravity information that is in the previous cycles and more. In addition for the first three cycles, the modeling of the solar pressure force for a rotating antenna through periapse passage is complicated, and solar pressure is a significant force for the higher periapse due to diminished drag. For these reasons, the first three cycles of data are not included in the gravity solution.

Cycle four began on September 15, 1992 and continued to May 24, 1993. During the complete cycle, there were no periapse altitude adjustments and the altitude varied between 185 and 165 km. Magellan was tracked through periapse with a two-second sample time, but for the spherical harmonic gravity solutions, the sample time was compressed to 10 seconds. With a periapse velocity of 8.5 km/s, 10 second samples provide two or three samples per half wavelength of a 90th degree and order field. For higher solutions, we may need to increase the number of samples near periapse. There are 770,000 10-second observations (both X and S-band) for cycle four. The time histories for Magellan cycle four are given in Appendix C. The location of periapse on the nightside and dayside (see local-solar-time plot in Appendix C) is apparent in the semi-major axis decay, with a greater drag on the dayside. Initially for cycle four, periapse is just coming out of occultation and hence a near face-on condition ( $<20^\circ$  plane-of-sky inclination) and shows degraded gravity information. At the end of the cycle, the geometry again returns to a near face-on condition, but full longitudinal coverage was obtained with periapse tracking. However, we've noticed degraded gravity information for orbits within  $20^\circ$  of the face-on geometry. Due to smaller eccentricity ( $e=0.4$ ), the Magellan cycle 4 data are much more sensitive at the higher latitudes than the PVO data (compare altitude vs latitude plots from the appendices), but still lack the high resolution gravity information for the higher latitudes.

At the end of May, 1993, Magellan periapse was lowered deep into the atmosphere to begin aerobraking. Over the next several months to early August, the atmospheric drag on the spacecraft changed the orbit to nearly circular to provide much lower altitude gravity tracking at the higher latitudes. From August 6, 1993 (August 17 for beginning of X-band) to October 10, 1994, Magellan was tracked in this nearly circular orbit with apoapse altitude varying from 600 km to 350 km and periapse altitude from 155 km to 220 km. Appendix D gives the time histories for the post-aerobraking orbit. This includes cycle five and part of cycle six until the Magellan spacecraft was "windmilled" into the atmosphere of Venus and lost signal. Even if the spacecraft had not been deliberately terminated, Magellan

would have been lost within several weeks due to degradation of the solar arrays and loss of power. It would have never been able to fill in some tracking data gaps that remain in the gravity field. The plane-of-sky inclination versus longitude in Appendix D clearly displays the coverage of the post-aerobraking data. Initially, periapse is occulted and apoapse is tracked from longitude  $100^{\circ}\text{W}$  to  $60^{\circ}\text{E}$ , then periapse becomes visible from  $220^{\circ}\text{E}$  to  $90^{\circ}\text{E}$  except for a gap due to superior conjunction. Apoapse tracking then resumes from  $110^{\circ}\text{W}$  to  $130^{\circ}\text{E}$ , and finally periapse is tracked from  $60^{\circ}\text{W}$  to  $10^{\circ}\text{E}$  for the conclusion of the mission. As a result, there is a gap between  $140^{\circ}\text{E}$  and  $220^{\circ}\text{E}$  where there is no direct low-altitude tracking for the high latitudes. This data gap especially shows up in the southern hemisphere. During cycles five and six, there are many maneuvers to adjust periapse and apoapse altitude and these are visible in the semi-major axis plot and others. The time of the maneuvers is noted on the semi-major axis plot. The same compression time of 10 seconds is used for the post-aerobraking data and amounts to 1,230,000 observations. The velocity of the Magellan spacecraft in the nearly circular orbit is about 7 km/s, providing a sample every 70 km.

The PVO and Magellan data were processed in many arcs (a data time span which is dynamically continuous) where for each arc the initial spacecraft state and other parameters are estimated (see Appendix F). The PVO data arcs were chosen to be as long as practical given the imperfect knowledge of the spacecraft non-gravitational accelerations. The arc lengths generally were shorter in regions where uncertainties in the non-gravitational accelerations (primarily those due to atmospheric drag) were highest. In addition, the data arcs did not include any propulsive maneuvers which, as mentioned above, occurred regularly on PVO from 1978 through 1982 due to solar gravitational perturbations. The arc lengths for the low-altitude PVO tracking data varied from a minimum of one day to a maximum of ten days, with six days as the typical length. The high-altitude PVO data arcs were three days in length to match the tracking schedule. For Magellan, the data arc lengths for pre- and post-aerobraking were generally one day in length with a maximum length of two days. The long term information in the gravity field can be enhanced by increasing the arc lengths if careful attention is given to the nongravitational forces acting on the spacecraft. This will be the focus of future work.

The Magellan orbits with X-band tracking provide the highest resolution gravity information for Venus. Appendix E is a summary of all the Magellan X-band tracking and lists the orbit number, tracking data file name, number of Doppler points, tracking station number, and the time for the first observation of the orbit. The name of the tracking file also indicates whether the sample time is 10 seconds or 2 seconds. The LOS accelerations for all these orbits, with respect to the gravity fields mentioned above, were delivered to the Geoscience Node, Planetary Data System (PDS), at Washington University in St. Louis (Simpson, 1995a, gives the format of the delivery). For the LOS data, the 2-second samples were used if available; this amounted to delivery of almost 6 million observations for about 4,600 orbits.

### 3. Models

In this section, we discuss the observable and the geometric and dynamic models that affect the processing of the Doppler observable. The geometric models include Earth platform parameters such as station positions, precession, nutation, etc., and media

calibrations for the observable due to the troposphere and ionosphere of the Earth. The dynamical models affect the spacecraft motion and are included in the numerical integration of the equations of motion for the spacecraft. In addition, any dynamic parameters that are estimated require that the partial of the spacecraft state with respect to the dynamical parameter be integrated. The parameters for the planetary ephemeris are both geometric and dynamic, but the change in force on the spacecraft due to a change in Earth position relative to Venus is negligible.

### *3a. Observable*

The DSN station transmits either an S-band or X-band signal to the spacecraft and the spacecraft multiplies the frequency by a factor depending on the band of the uplink and downlink. For two-way S-band, the multiplier is 240/221 and for two-way X-band the factor is 880/749 (Moyer, 1987, documents the formulation for the X-Band Observable). The signal is then received at the DSN and the phase difference between the received and transmitted signal is measured with a Doppler cycle counter. The Doppler counter outputs the phase difference at integral times (in cycles and fraction of the last cycle). The Doppler observable is the average change in phase over the count or sample time (the phase difference divided by the count time), and is thus a differenced range measurement and not an instantaneous line-of-sight velocity (see Moyer, 1971).

The transmitting frequency can either be constant or ramped (linear with time). The majority of the PVO data have constant transmitting frequencies and the Magellan data were ramped until November 19, 1993 and mostly constant thereafter. From August 1993 to November 1993 for Magellan, there were some instances of incorrect reporting of the ramp rates in the last significant digit. There is no listing of these ramp errors but the error can be noticed in the residuals because of the discontinuity it causes in the observable on the order of 1 mm/s. If this discontinuity does not match with the momentum wheel desaturations, then it is probably a ramp error and it can be removed by increasing or decreasing the ramp rate by 0.000005 Hz/sec. In addition for Magellan, there are several occurrences in cycle 5 (mostly December 1993 and January 1994) where the incorrect reference frequency is reported, and this required the estimation of a Doppler bias on the order of 1000 mm/s. The reference frequency was not chosen as an integral number and thus was truncated to fit within the file format. Again for Magellan, there are also instances where one-way Doppler data were reported as two-way Doppler data, but these are easily identified as blunder points. The Doppler data file formats (ODF, Orbit Data File, and ATDF, Archival Tracking Data File) are available from the Geosciences Node, Planetary Data System (PDS), at Washington University in St. Louis, Missouri or from parts of a JPL DSN document that were contributed by Goltz (1988a and 1988b).

The major contribution to the observable is the relative velocity of Venus with respect to the Earth which varies between  $\pm 13$  km/s. Since the noise of the Magellan X-band observable is less than 0.1 mm/s, this is a measure of the Venus-relative-to-Earth ephemeris in the tenth significant digit. The next major contributor to the observable is the orbit velocity of the spacecraft about Venus which varies between 1 and 9 km/s. The last major contributor to the observable is the motion of the Earth station with a velocity less than 0.5 km/s.

Table 1. Tracking Station Cylindrical Coordinates.

DSN Station	Longitude (deg)	Z height (km)	Spin radius (km)
11	243.150581357	3673.7640164	5206.3398806
12	243.194514844	3665.6309210	5212.0544322
13	243.205115543	3660.9568700	5215.4841386
14	243.110465567	3677.0522364	5203.9968496
15	243.112808584	3676.6699703	5204.2342885
16	243.126353832	3669.3861410	5209.3695231
42	148.981263719	-3674.5822320	5205.3523453
43	148.981263716	-3674.7487034	5205.2514376
44	148.977789576	-3691.3475374	5193.9817946
45	148.977682009	-3674.3815553	5205.4946063
46	148.983078061	-3674.9756700	5205.0754067
61-34m	355.750974037	4114.8843050	4862.6104361
61-26m	355.750974037	4114.8823280	4862.6081161
62	355.632163870	4116.9054796	4860.8179889
63	355.751987690	4115.1089216	4862.4509999
65	355.748578096	4114.7486263	4862.7173018
66	355.748529707	4114.9997980	4862.5302573

Table 2. DSN Plate Motion Velocities in cm/year.

Complex	East	North	Vertical
Goldstone (10)	-1.98	-0.57	-0.01
Canberra (40)	1.97	5.06	0.01
Madrid (60)	2.11	2.55	0.11

### 3b. Geometric Models

The planetary ephemeris is given by the state of the art JPL model DE403 as described by Standish et al (1995), and is a significant improvement over JPL model DE200 (Standish, 1990). The accuracy of DE403 is almost an order of magnitude better than DE200 for the Venus line-of-sight velocity with respect to the Earth. DE403 is oriented with respect to the International Earth Rotation Service (IERS) coordinate frame and is consistent with the IERS station coordinates that are used in this gravity solution. The initial state of the Earth and Venus are also estimated using the Set III variables of Brouwer and Clemence (1961).

The station locations are given by JPL VLBI solution "SSC(JPL) 91 R 01" which was submitted to the 1990 IERS Annual Report (Steppe et al, 1991). The station positions are listed in Table 1. They are in the IERS frame with respect to a 1988.0 epoch and include vertical corrections when used for Doppler measurements instead of VLBI measurements (7 cm for the 70m antennas and 1.5 cm for the 34m HEF X-band stations, Folkner, 1992b). The coordinates are for the geocentric metric and are scaled to the barycentric metric by the Orbit Determination Program (ODP, Moyer, 1990); this scaling has a 0.01 mm/s signature in the Doppler. The relative position uncertainty between stations is about 2-3 cm per component with a geocentric uncertainty of about 10cm

(Folkner, 1992a). The plate motion model is given by ITRF93 of IERS (Boucher et al, 1994) and is listed in Table 2. The combined uncertainties in the station positions and plate motion model result in errors in the Doppler observable of 0.01 mm/s or less for both the PVO and Magellan Doppler data. The PVO spacecraft was tracked by DSN stations 11, 12, 14, 42, 43, 44, 61, 62, and 63, and Magellan by stations 12, 14, 15, 42, 43, 45, 61, 63, and 65. The positions of stations 11, 44, and 62 are given by Moyer (1989) with respect to the 70m stations (14,43,63) from intercomplex survey data (to an accuracy of about 10cm). However, all the tracking stations for Magellan are given by Steppe et al (1991). Station 61 was upgraded from a 26-meter antenna to a 34-meter antenna during August 9, 1979 to March 31, 1980 (Moyer, 1983). The station platform was raised exactly 10 feet and this is reflected in the station coordinates given in Table 1. (Station 12 was also upgraded and raised to a 34m antenna from June 1, 1978 to December 1, 1978, but this is prior to the orbit insertion for PVO). The two-way X-band data are transmitted and received by only the 34m HEF stations 15, 45, and 65. The station coordinates are corrected by the ODP for solid earth tides (0.015 mm/s amplitude in Doppler) and pole tide ( $<0.001$  mm/s).

The Earth orientation parameters (UT1-TAI, TAI-UTC, and polar motion) are given by the University of Texas, Center for Space Research solution "EOP(CSR) 95 L 01" submitted to IERS (1994 IERS Annual Report) for Magellan data and JPL solution "EOP(JPL) 91 C 01" submitted to IERS (Gross, 1992, also called Space91) for PVO data. For Magellan, the IERS solutions for UT1 and polar motion are better than 0.01 millisecond and 0.1 milliarcsecond, and the solution uncertainties for the PVO time frame are at least an order of magnitude greater than these values (1994 IERS Annual Report). Figures 1, 2, and 3 show the differences between the UT1 and polar motion solutions of U. of Texas and Space91 for the PVO time frame. The Doppler signatures from these Earth orientation errors are about 0.02 mm/s for PVO and negligible for Magellan. A UT1 bias is estimated for each PVO arc with an a priori of 1 millisecond, but the resulting estimate sigmas are not significantly improved. The precession and nutation models are given by the 1976 IAU precession (Lieske et al, 1977) and 1980 IAU nutation models (Seidelmann, 1982). Corrections to the IAU precession and nutation models have been applied using the terms from Folkner (1994a). The resulting error in the precession and nutation for the PVO and Magellan time frame (1979-1994) is less than 10 nrad (6 cm).

The DSN stations record the Doppler observation in Station Time (ST). The differences between ST and UTC at each station complex are available for the Magellan data but not the PVO data. The time differences for Magellan are less than one microsecond and contribute only a small signature to the Doppler residual ( $<0.01$  mm/s). The conversion from UTC to TAI is then given by "EOP(CSR) 95 L 01" or "EOP(JPL) 91 C 01" and the ET-TAI calculation is outlined by Moyer (1981). The relativistic delay of the signal due to the gravitational mass of the Sun is given by Moyer (1977) as a function of the relativity parameter  $\gamma$ . This effect on the Doppler observable is on the order of 1 mm/s for the Sun and is negligible for the relativistic terms of the planets ( $<0.002$  mm/s).

A seasonal troposphere model for each DSN complex in the form of a Fourier series (see Estefan and Sovers, 1994) is applied to the Magellan and PVO observables. The errors in the seasonal model can be as large as 0.1 mm/s for the low elevation data. Future gravity solutions will include a daily tropospheric correction to the seasonal model for the Magellan Doppler data only (supplied by the JPL Tracking System Analytical Calibration or



Figure 1: Space91 and Texas UT1 Daily Differences

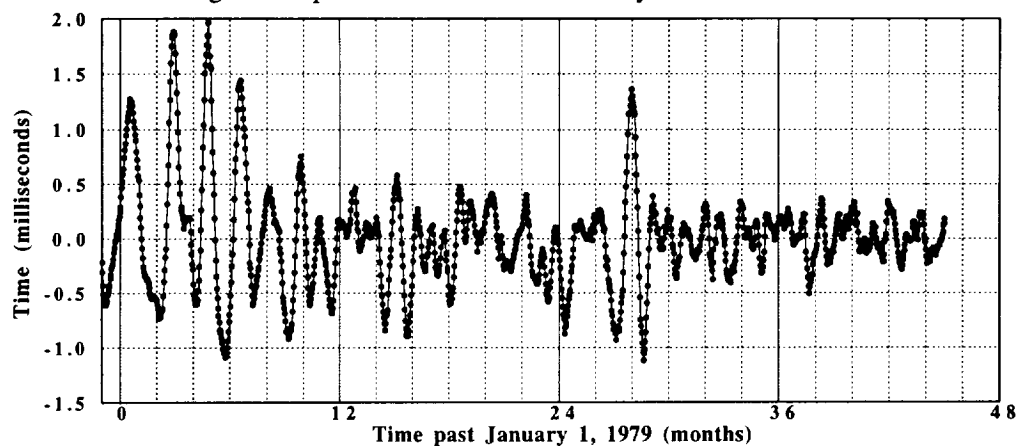


Figure 2: Space91 and Texas X-Pole Daily Differences

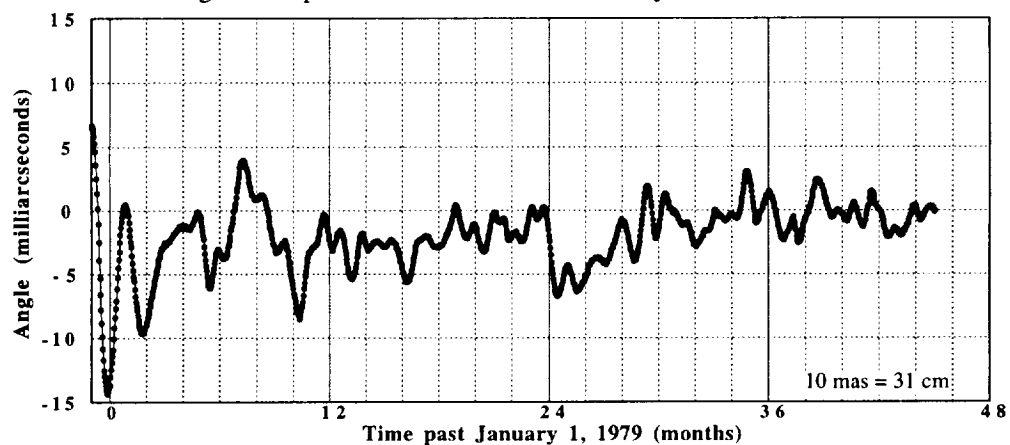
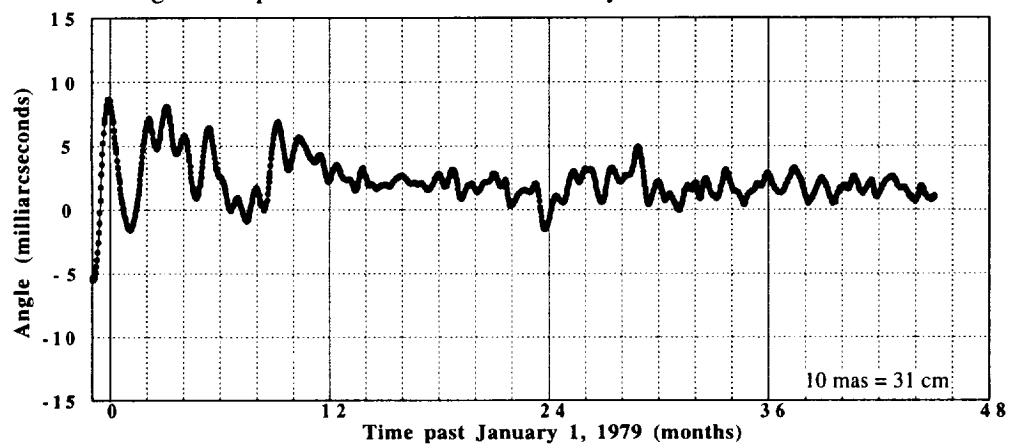
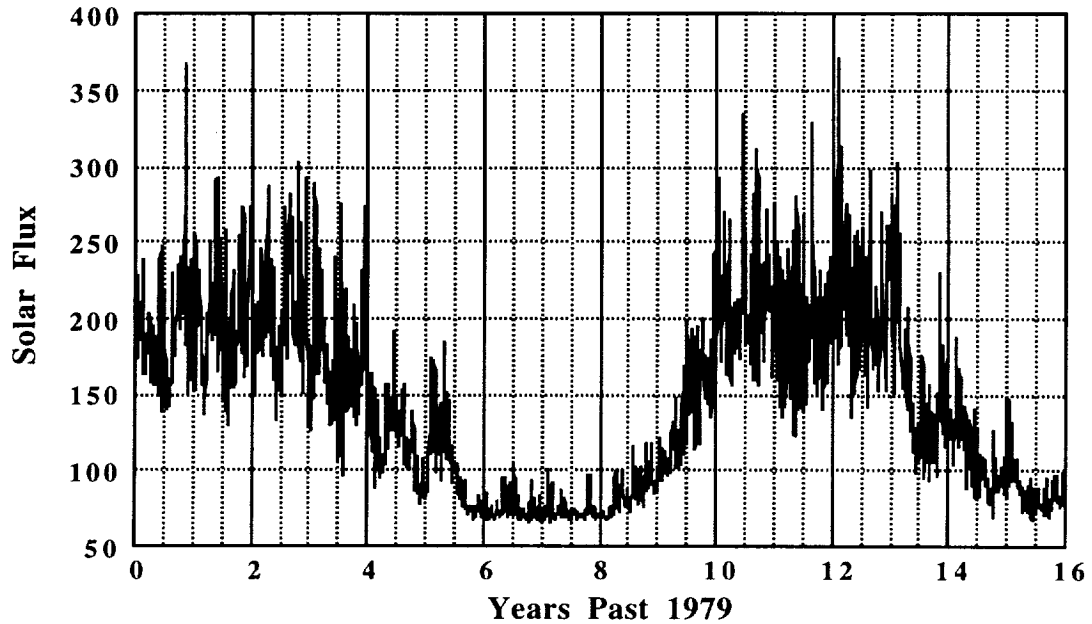


Figure 3: Space91 and Texas Y-Pole Daily Differences



**Figure 4: Daily Solar Flux for PVO and Magellan Time Frame**



TSAC group and based upon weather data). At the present, any observations with an elevation below  $10^\circ$  are deleted.

The charged particle delay is a major effect for the Doppler S-band data (on the order of 1 mm/s) and is due to solar plasma and the Earth's ionosphere. Calibrations from the Earth's ionosphere were used for both PVO and Magellan (again provided by JPL TSAC) and are accurate to about 10% (Royden, private communication, JPL, 1995). However for the older PVO data, there are some time spans where Faraday rotation data could not be obtained. These times are the first three months of PVO data where no calibrations were used for Madrid and for March 1982 to June 1982 for Canberra which were filled in with an empirical seasonal (Bent et al, 1976) model prediction accurate to about 30%. The Magellan calibrations are based upon GPS data. The ionosphere delay is approximately proportional to the solar flux which is displayed in Figure 4, and all the PVO data are near maximum solar activity and the Magellan gravity data are near solar minimum. Some very limited PVO data exists with S-band and X-band downlink, and ionospheric delays for the downlink could be computed, but this has not been pursued. The charged particle delay uncertainty for the PVO data is the limit for much of the information that can be obtained from the data, such as the ephemeris of Venus.

### *3c. Dynamic Models*

The dynamic models consist of all forces acting on the spacecraft. The gravitational attraction of the Sun and planets other than Venus are modeled as point masses with the positions given by the JPL DE403 ephemeris. The major contributor is the Sun with an acceleration of  $1 \times 10^{-9} \text{ km/s}^2$ . The relativistic acceleration on the spacecraft (Moyer, 1971) is largest due to Venus and is about  $1 \times 10^{-9} \text{ km/s}^2$  at periape with the Sun contribution four

orders of magnitude smaller. The force is predominantly in the radial direction and inversely proportional to the distance squared (equivalent to a change in GM).

The gravitational potential of Venus is modeled by a spherical harmonic expansion with normalized coefficients ( $\bar{C}_{nm}$ ,  $\bar{S}_{nm}$ ) and is given by

$$U = \frac{GM}{r} + \frac{GM}{r} \sum_{n=2}^{\infty} \sum_{m=0}^n \left(\frac{a_e}{r}\right)^n \bar{P}_{nm}(\sin \phi) [\bar{C}_{nm} \cos m\lambda + \bar{S}_{nm} \sin m\lambda] \quad (1)$$

where  $n$  is the degree and  $m$  is the order,  $\bar{P}_{nm}$  are the fully normalized associated Legendre polynomials,  $a_e$  is the reference radius of Venus (6051.0 km for our models),  $\phi$  is the latitude, and  $\lambda$  is the longitude. The normalized coefficients are related to the unnormalized by (see Kaula, 1966)

$$(\bar{C}_{nm} ; \bar{S}_{nm}) = \left[ \frac{(n+m)!}{(2-\delta_{0m})(2n+1)(n-m)!} \right]^{1/2} (C_{nm} ; S_{nm}) \quad (2)$$

where  $\delta_{0m}$  is the Kronecker delta function and  $\bar{C}_{n0} = -\bar{J}_n$ . The harmonic coefficients of degree one are fixed to zero since the origin of the coordinate system is chosen to be the center of mass of the body. The body-fixed coordinate system is nominally given by the 1991 IAU values (Davies et al, 1992a, 1992b) for Venus pole position and rotation rate. The pole and rate are fixed to the 1991 IAU values for the final gravity solution delivered to the scientific community. However, we also present below our solutions for the pole and rate.

The normalized gravity coefficients are estimated complete to degree and order 90 (8277 coefficients). However, the gravity analysis for Venus is not complete with a 90th degree and order solution. The Magellan Doppler tracking data contain information about the Venus gravity field to about harmonic 120 for much of the planetary surface with the equatorial band resolution perhaps to degree 180 (Kaula, 1995). Determination of a higher degree and order gravity field for Venus will be a part of future work. A 120th degree and order field (15,000 parameters) is easily within reach on the JPL Cray T3D Supercomputer. The nominal gravity field for this 90th degree solution (MGNP90LSAAP) is the previous 90th degree solution (or iteration, MGNP90KSAAP).

Also modeled and estimated is the tidal effect on Venus due to the Sun. This force causes a time varying component of the second degree harmonics as a function of the body-fixed position of the Sun. The relationships for corrections to the normalized coefficients are (see McCarthy et al, 1989)

$$\Delta \bar{C}_{20} = \frac{1}{\sqrt{5}} k_2 \frac{GM_s R^3}{GM_v r_s^3} \left[ \frac{3}{2} \sin^2 \phi_s - \frac{1}{2} \right]$$

$$\Delta \bar{C}_{21} = \sqrt{\frac{3}{5}} k_2 \frac{GM_s R^3}{GM_v r_s^3} \sin \phi_s \cos \phi_s \cos \lambda_s$$

$$\Delta \bar{S}_{21} = \sqrt{\frac{3}{5}} k_2 \frac{GM_s R^3}{GM_v r_s^3} \sin \phi_s \cos \phi_s \sin \lambda_s \quad (3)$$

$$\Delta \bar{C}_{22} = \sqrt{\frac{3}{20}} k_2 \frac{GM_s R^3}{GM_v r_s^3} \cos^2 \phi_s \cos 2\lambda_s$$

$$\Delta \bar{S}_{22} = \sqrt{\frac{3}{20}} k_2 \frac{GM_s R^3}{GM_v r_s^3} \cos^2 \phi_s \sin 2\lambda_s$$

where  $\phi_s$  is the latitude of the Sun,  $\lambda_s$  is the longitude of the Sun, and  $M_v$  is the mass of Venus. The Love number  $k_2$  is estimated. Since the latitude of the Sun is only a few degrees, the only significant time varying term occurs for the  $\bar{C}_{22}$  and  $\bar{S}_{22}$  coefficients. The expected amplitude for the normalized coefficients for a Love number of 0.25 is  $7.1 \times 10^{-9}$ ; the other periodic terms have amplitudes two orders of magnitude smaller. If the Doppler tracking data determine the  $\bar{C}_{22}$  and  $\bar{S}_{22}$  coefficients to this level over various solar longitudes then the tidal effect of Venus can be determined. The solution for  $\bar{J}_2$  given in this report has the permanent (or constant) part of the tide removed from it. To get the total  $\bar{J}_2$ , one must add  $4.1 \times 10^{-9}$ .

A major dynamic effect on the spacecraft is atmospheric drag with alongtrack accelerations for PVO reaching  $1 \times 10^{-6} \text{ km/s}^2$  for the daytime atmosphere at 150 km altitude. The density profile for the Venus atmosphere is given by the Venus International Reference Atmosphere (VIRA) model. It is a multilayered exponential model with density values at 5-km intervals in altitude and profiles given at different local solar times (Keating et al, 1985). The local solar time (LST) is defined by the direction of Venus rotation which is retrograde (the morning terminator=6am), and is the angle between the longitude of periaapse and the longitude of the Sun. The 23 total atmospheric layers extend from 140 km to 250 km altitude and the VIRA model is symmetric about noon and midnight LST. The atmospheric drag on the orbit is estimated for every periaapse passage for both Magellan and PVO. The exponential scale-height values for each layer are held fixed and the density at the lowest layer of 140 km is estimated (thus changing the density at each layer). For periaapse altitudes above 250 km (including the 1000-km altitude PVO data), a single-layered atmosphere is used with scale-height values remaining a function of LST. Table 3 gives the scale height for each layer of the VIRA model and the base density at 140 km. For a given spacecraft LST at periaapse, the atmospheric densities are determined by linearly interpolating the corresponding densities from Table 3.

For the PVO low-altitude data, a lift to drag coefficient is estimated for every data arc. The PVO spacecraft is basically a cylinder (with the antenna being a smaller component) and with the axis of symmetry pointed to the north ecliptic. The cylinder has a radius of 50 inches and a height of 48 inches. Since PVO approaches periaapse from the northern latitudes, the angle of attack (the angle between the symmetry axis and the velocity vector) is about  $22^\circ$  and so the flat plate at the base of the cylinder is the major contributor to the lift force. For free molecular flow, the coefficient of lift to drag,  $C_{l/d}$ , should be in the direction away from Venus (this is a negative  $C_{l/d}$  as given by the ODP software).

Table 3. VIRA Atmosphere Model.

Altitude (km)	Local Solar Time						
	Midnight	5	6	7	8	10	Noon
<i>Base Density, <math>10^{-12}</math> (gm/cm<sup>3</sup>)</i>							
140	0.31	0.48	1.15	2.52	3.58	3.09	6.13
<i>Scale Heights (km)</i>							
140	4.1	4.4	4.4	4.8	5.0	6.6	5.3
145	5.1	5.4	5.2	5.5	5.7	6.6	5.8
150	6.1	6.5	6.1	6.3	6.5	6.6	6.3
155	6.9	7.7	7.3	7.2	7.4	7.5	7.1
160	7.4	8.7	8.6	8.3	8.4	8.4	8.0
165	7.7	9.7	9.8	9.5	9.5	9.5	8.9
170	8.1	10.4	11.0	10.7	10.6	10.7	10.0
175	8.5	11.0	11.9	11.8	11.8	11.8	11.1
180	9.0	11.9	12.7	13.0	13.1	12.8	12.2
185	9.7	12.2	13.2	13.9	13.8	13.8	13.4
190	10.9	13.1	13.9	14.6	14.8	14.9	13.9
195	12.7	14.2	14.1	15.2	15.6	15.4	14.9
200	15.4	15.5	14.5	15.7	16.2	16.0	15.5
205	19.3	17.0	14.9	16.1	16.7	16.6	15.9
210	24.3	19.1	15.4	16.4	17.0	16.8	16.5
215	30.7	21.3	15.6	16.7	17.5	17.2	16.7
220	36.5	24.9	16.4	17.0	17.6	17.4	16.9
225	43.6	27.3	16.7	17.2	17.9	17.7	17.4
230	50.6	31.0	17.8	17.2	18.1	17.9	17.5
235	55.2	34.9	18.6	17.6	18.3	18.1	17.7
240	59.5	38.4	19.7	17.6	18.3	18.1	17.8
245	62.1	41.5	21.1	18.5	18.8	18.3	18.1
250	62.1	41.5	21.1	18.5	18.8	18.3	18.1

The solar radiation pressure force for both PVO ( $1.3 \times 10^{-10}$  km/s<sup>2</sup>) and Magellan ( $2.7 \times 10^{-10}$  km/s<sup>2</sup>) is accounted for in each arc by estimating one coefficient in each of three orthogonal directions (Sun-spacecraft line, ecliptic north direction, and in the ecliptic normal to the Sun-spacecraft direction). The PVO spacecraft is a simple spinning cylinder with a smaller antenna continuously pointed to Earth. The coefficients will change with time due to the change in antenna position. This is noticeable in the high-altitude PVO data. The Magellan spacecraft, however, goes through many orientation changes to either heat up or cool down ("hide") the spacecraft. These changes are modeled by estimating an acceleration vector for each hide, and may be as short as 10 minutes or as long as two hours. The spacecraft orientation is changed with the momentum wheels and there is no thrusting. The acceleration thus absorbs the change in the solar pressure force on the spacecraft due to the new orientation. Also, the Magellan spacecraft goes through an orientation change near apoapse for star calibration. In that case, the solar pressure force change is modeled with a small (a priori of 0.3 mm/s) delta velocity estimation. With the current arc lengths of one day for Magellan, these small solar pressure effects (hides, star calibrations) are small and have negligible effects on the gravity estimation. However, with

longer data arcs, these effects may become important. The hide history for Magellan is listed in Appendix F.

The radiation force from Venus albedo is a ring model (Knocke and Ries, 1987) where a simple bus model is used for Magellan and a cylindrical model is used for PVO. The albedo force is basically undetermined for Magellan and the low-altitude PVO data due to the atmospheric drag. For the high-altitude PVO, the albedo force is significant. The mean albedo value is 0.76 (Taylor et al, 1983) and variations in albedo are allowed for by estimating a scale factor for the albedo for each data arc. The albedo force is approximately  $1 \times 10^{-10} \text{ km/s}^2$ , and is about four times smaller than the tidal force ( $k_2$ ). The radial components of the tide, albedo, and drag forces for PVO and Magellan are displayed in Figures 5, 6, 7, and 8. The examples are for orbits with a local solar time near noon. The drag force for the high-altitude PVO orbits is several orders of magnitude smaller than the albedo and tidal forces, but reaches  $1 \times 10^{-8} \text{ km/s}^2$  in the radial direction for the low-altitude PVO orbits. In solutions for these forces, the tide generally correlates with the initial spacecraft state and solar pressure and albedo with the drag due to a nonconservative part of the force (the albedo force has a mean acceleration in the velocity direction). The variational equation for the semi-major axis ( $a$ ) is (Battin, 1987)

$$\frac{da}{dt} = \frac{2va^2}{GM_v} a_{dt} \quad (4)$$

where  $v$  is the spacecraft velocity,  $a_{dt}$  is the acceleration along the velocity direction. Even though the tide force is also larger than albedo in the along-track direction, the average rate of change of the semi-major axis (the integral over one orbit in equation (4)) for the albedo force is an order of magnitude greater (1 m/day vs 0.1 m/day) than the tide or drag. The formal uncertainty in the semi-major axis for the high-altitude 3-day PVO arcs is about 2 meters. Hence, the albedo is fairly well determined for the PVO high-altitude orbits but the tidal effect is better determined for the low-altitude orbits. The drag force is substantially lower for Magellan than PVO due to higher altitudes and lower spacecraft velocity through the atmosphere. The drag force for the near circular orbit is even lower still for the same reasons. The tidal force can, in part, be better separated from the other forces because on the nightside of Venus the tidal force remains the same, the albedo force vanishes, and the drag force diminishes by an order of magnitude.

The Magellan spacecraft attitude was maintained with the use of momentum wheels, and they were also used to change the orientation of the spacecraft. These changes did not impart any force on the spacecraft. However, due to atmospheric drag torques on the spacecraft, the momentum wheels had to be despun or desaturated every orbit or about 8 times per day for cycle four and 15 times per day for cycles five and six. Prior to the gravity cycles, the desaturations occurred about three times per day. The desaturations imparted an incremental velocity to the spacecraft of about 1 mm/s and required estimation of the three components of the velocity vector. These desaturations greatly reduced the long term gravity information in the Magellan data.

All the above forces on the spacecraft are included in the numerical integration of the spacecraft state ( $d^2\mathbf{r}/dt^2 = \text{forces}$ ) in rectangular coordinates of the Earth mean equator of J2000 coordinate system. The integrator is a multistep Adams type predictor-corrector that varies the order to obtain the largest possible step size. We use an absolute integration

Figure 5: Radial Acceleration Profile for High-Altitude PVO

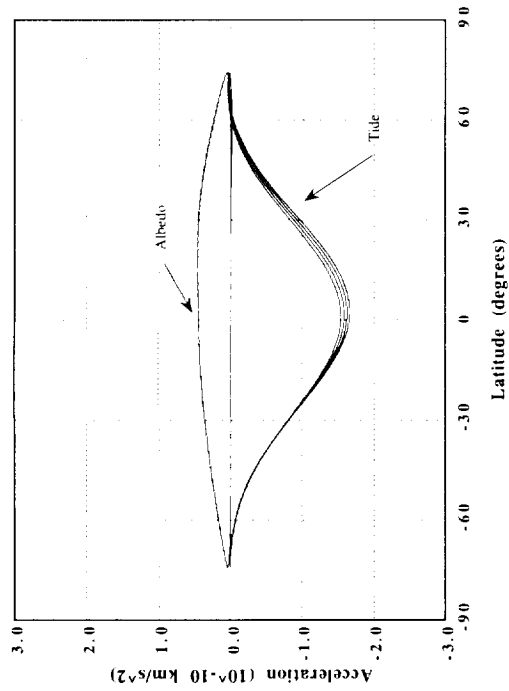


Figure 6: Radial Acceleration Profile for Low-Altitude PVO

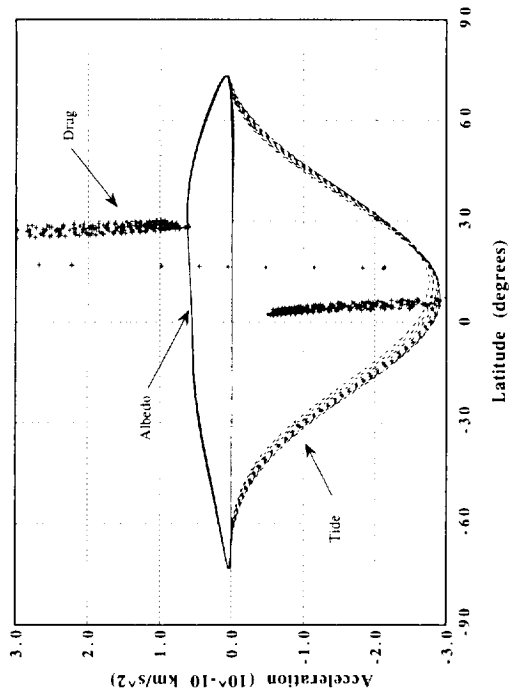


Figure 7: Radial Acceleration Profile for Magellan Cycle 4

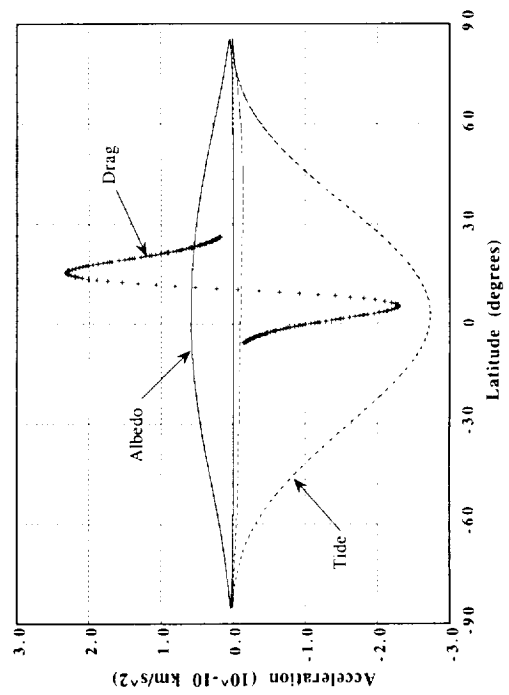
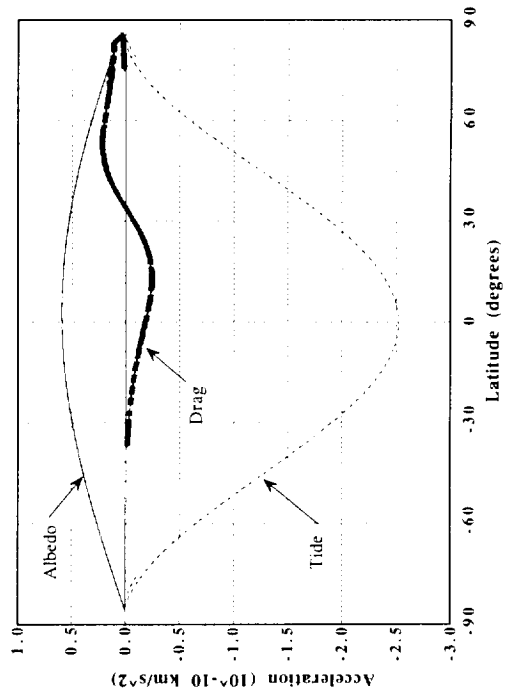


Figure 8: Radial Acceleration Profile for Magellan Cycle 5&6



tolerance of  $2 \times 10^{-11}$ , and this results in numerical noise for the Doppler observable of less than 0.01 mm/s.

## 4. Estimation Procedure

### 4a. Determination of Unconstrained Gravity Field

The JPL gravity estimation software is based upon the Orbit Determination Program or ODP (see Moyer, 1971); the software set used at JPL for navigation of all planetary spacecraft. This FORTRAN code was used for the numerical integration and processing of the Doppler observable to produce an observation equation (using all the geometric and dynamic models discussed above). The ODP was modified by the authors for use on the JPL Cray T3D supercomputer, a parallel computer with 256 DEC alpha processors. The filter which then processes the observation equations, however, was written specifically for the Cray T3D (by C.L. Lawson at JPL, for more specific details of the T3D software see Konopliv, 1995b). The use of the Cray has dramatically reduced the amount of computer time from years to days to generate the gravity solution. The spacecraft state and other parameters are estimated using a weighted least-squares filter based upon the square root of the information matrix (see Lawson and Hanson, 1995; Bierman, 1977). The parameters that are estimated consist of arc-dependent or local variables (spacecraft state, atmospheric densities, etc.) that are determined separately for each data arc (i.e., the arcs listed in Appendix F) and global variables (harmonic coefficients, etc.) that are common to all the data arcs.

Initially, we converge the data arcs by estimating only the local variables using the nominal values for the global variables. The observations of each arc are weighted according to data root mean square (rms) of that arc with a separate rms for each tracking station pass and with the rms including corrections for the count times of the observations. The actual data weight used is the rms multiplied by a factor of two with an additional correction factor for the observation elevation. Since the PVO and Magellan orbits are nearly polar, the groundtracks converge near the pole and the observations become more dense. For this reason, the observation sigma is adjusted for latitude  $\phi$  ( $\sigma_{\text{new}} = \sigma_{\text{old}} \cdot \cos^{-1/2} \phi$ ).

The Doppler data (i.e. in the frequency domain,  $f$ ) are treated as white noise, and theoretically, the rms of the data is inversely proportional to the square root of the sample time. However, due to the charged particle effects of the solar plasma, the noise follows a  $f^{-8/3}$  power spectrum instead of the white  $f^{-2}$  spectrum (Folkner, 1994b). This is true for count times greater than about one minute; for count times shorter than one minute, the noise is white. This implies that there is more noise in the data for the longer count times than what is modeled. As a result, the uncertainties from the estimation process are too small (or optimistic) for the shorter wavelengths of the gravity field and too large (or pessimistic) for the longer wavelengths. At this time we have not devised a method to account for this noise spectrum. For the  $f^{-8/3}$  spectrum, the rms is inversely proportional to the sixth root of the sample time.

Once the local variables are converged, the global parameters are determined with a technique described by Ellis (1980) that merges only the global parameter portion of the square root information (or SRIF) arrays from all the arcs, but is equivalent to solving for the global parameters plus local parameters of all arcs. For each data arc, the local variables



estimated are the spacecraft state, three solar pressure coefficients, a factor for the Venus albedo, the base density for each periapse passage through the atmosphere, the lift-to-drag coefficient for the low-altitude PVO orbits, velocity vector increments for the momentum wheel desaturations and star calibrations of Magellan, acceleration vectors for the hides of Magellan, and a UT1 bias for the PVO arcs. The a priori uncertainties for the spacecraft state are large (20 km). The a priori base density uncertainties for the PVO orbits are large but are more tightly constrained for Magellan ( $1 \times 10^{-12} \pm 1 \times 10^{-12}$  gm/cm<sup>3</sup>). Future work will constrain the Magellan base densities more closely to the VIRA model. The a priori on the Magellan desaturations are  $5 \times 10^{-6}$  km/s and for the star calibrations are  $3 \times 10^{-7}$  km/s. The hides are constrained to  $10^{-10}$  km/s<sup>2</sup>.

The following global parameters are estimated: the normalized spherical harmonic coefficients ( $\bar{C}_{nm}$ ,  $\bar{S}_{nm}$ ) of the gravity field complete to degree and order 90, the gravitational constant times the mass of Venus (GM), the ephemerides of Earth and Venus (12 parameters), the Love number for Venus, the right ascension and declination of the Venus spin axis or pole, and the rotation rate for Venus. An SRIF array for the global parameters is obtained for three data sets (PVO, Magellan cycle four, and Magellan cycles five and six) where there is no constraint on the global variables. Combinations of these SRIF arrays together with a priori constraints on the global parameters are used to find solutions for the global variables. The a priori constraint on the gravity field is discussed in the next section.

#### 4b. Gravity A Priori

Once all the global information is packed from all the data arcs, the gravity field is constrained with an a priori. The common method is to constrain each harmonic coefficient toward zero with an uncertainty given by the Kaula rule (Kaula, 1966) for that particular planet (used, for example, in Konopliv et al. 1993a, Konopliv et al. 1993b, Nerem et al. 1993, McNamee et al. 1993, Smith et al., 1993, Lemoine, 1992, Lemoine et al 1995). The Kaula rule used for Venus is  $1.2 \times 10^{-5} / n^2$  where  $n$  is the degree of the coefficient. The second a priori constraint method is a spatial constraint and is also outlined for Mars in Konopliv and Sjogren (1995a).

The a priori constraint applied for this gravity field evaluates the radial acceleration and its uncertainty on the reference sphere (i.e.,  $r = a_e$ ). At that surface, the radial acceleration ( $a_n$ ) from all coefficients of degree  $n$  is given by

$$a_n = \frac{GM}{a_e^2} (n+1) \sum_{m=0}^n \bar{P}_{nm}(\sin \phi) (\bar{C}_{nm} \cos m\lambda + \bar{S}_{nm} \sin m\lambda) \quad (5)$$

To create a profile of acceleration contributions versus degree, the rms of the acceleration  $a_n$  is obtained over the sphere. The mean of the square of the acceleration ( $a_n$ )<sub>ms</sub> of equation (5) is given by

$$(a_n)_{ms} = \left[ \frac{GM}{a_e^2} (n+1) \right]^2 \frac{1}{4\pi} \times \int_0^{2\pi} \int_{-\pi/2}^{\pi/2} \left[ \sum_{m=0}^n \bar{P}_{nm}(\sin \phi) (\bar{C}_{nm} \cos m\lambda + \bar{S}_{nm} \sin m\lambda) \right]^2 \cos \phi \, d\phi \, d\lambda$$

Since the spherical harmonics are orthogonal, we obtain

$$(a_n)_{ms} = \left[ \frac{GM}{a_e^2} (n+1) \right]^2 \sum_{m=0}^n (\bar{C}_{nm}^2 + \bar{S}_{nm}^2)$$

As a good approximation, the rms magnitude spectrum of the gravity coefficients follows the Kaula rule and is given by

$$\left[ \frac{\sum_{m=0}^n (\bar{C}_{nm}^2 + \bar{S}_{nm}^2)}{2n+1} \right]^{1/2} = K/n^2$$

where  $K$  is the constant for the particular planet ( $1.2 \times 10^{-5}$  for Venus). The expected acceleration profile is then given by (for  $n \gg 1$ )

$$(a_n)_{rms} = \frac{GM}{a_e^2} K \sqrt{2/n} \quad (6)$$

which for Venus is

$$(a_n)_{rms} = 15 / \sqrt{n} \text{ milligals} \quad (7)$$

This is the expected "signal" for the acceleration at each point on the surface of the reference sphere. The signal could also be determined empirically by taking the rms of a given gravity field over different regions. However, for this work, only one signal profile is used for all latitudes and longitudes.

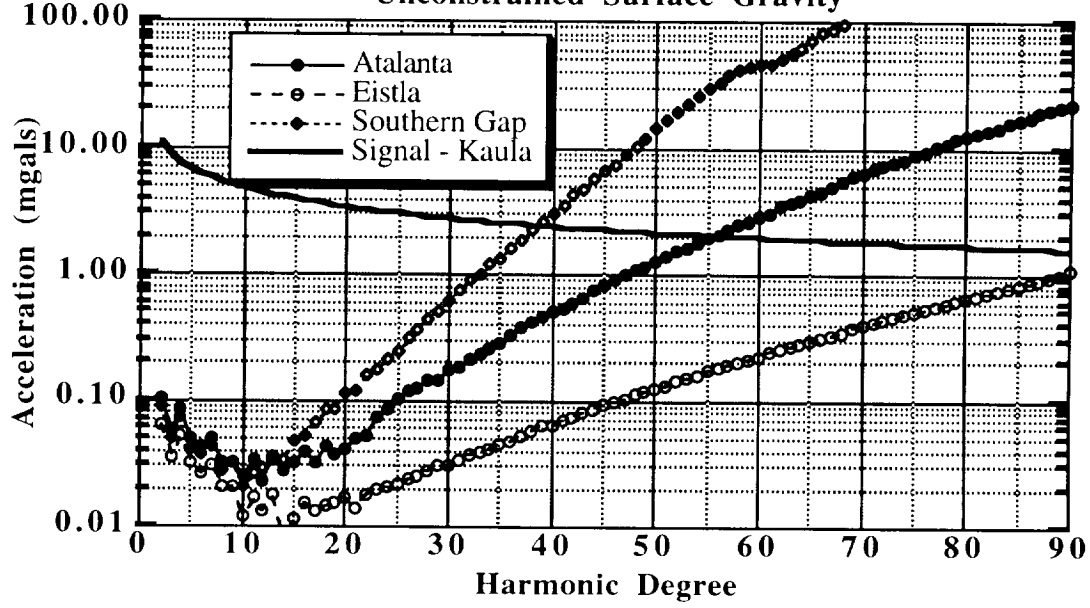
The next task is to map the acceleration uncertainty at the surface into an uncertainty or "noise" profile showing the error in acceleration versus harmonic degree. The acceleration uncertainty from the summed contributions of all coefficients from degree 2 to  $n$ ,  $\sigma(a_{2,n})$ , is given by

$$\sigma(a_{2,n}) = \frac{\partial a_{2,n}^T}{\partial \mathbf{G}_{2,n}} \mathbf{P}_{\text{noap}(2,n)} \frac{\partial a_{2,n}}{\partial \mathbf{G}_{2,n}}$$

where  $\mathbf{G}_{2,n}$  is the vector of all normalized gravity coefficients from degree 2 to  $n$  and  $\mathbf{P}_{\text{noap}(2,n)}$  is the corresponding covariance. The covariance of the coefficients from degree 2 to  $n$  is the covariance as if the higher degree coefficients ( $>n$ ) are not estimated. Hence, it is a truncation, or submatrix, of the full 90th degree and order covariance without any constraint applied to the gravity field. The partial of the acceleration with respect to the coefficients of degree  $n$  and order  $m$  are functions of latitude and longitude and are given by

$$\frac{\partial a_{2,n}}{\partial \bar{C}_{nm}} = \frac{GM}{a_e^2} (n+1) \bar{P}_{nm}(\sin \phi) \cos m\lambda \quad (8)$$

Figure 9: Acceleration Profiles for Venus  
Unconstrained Surface Gravity



$$\frac{\partial a_{2,n}}{\partial \bar{S}_{nm}} = \frac{GM}{a_c^2} (n+1) \bar{P}_{nm}(\sin \phi) \sin m\lambda$$

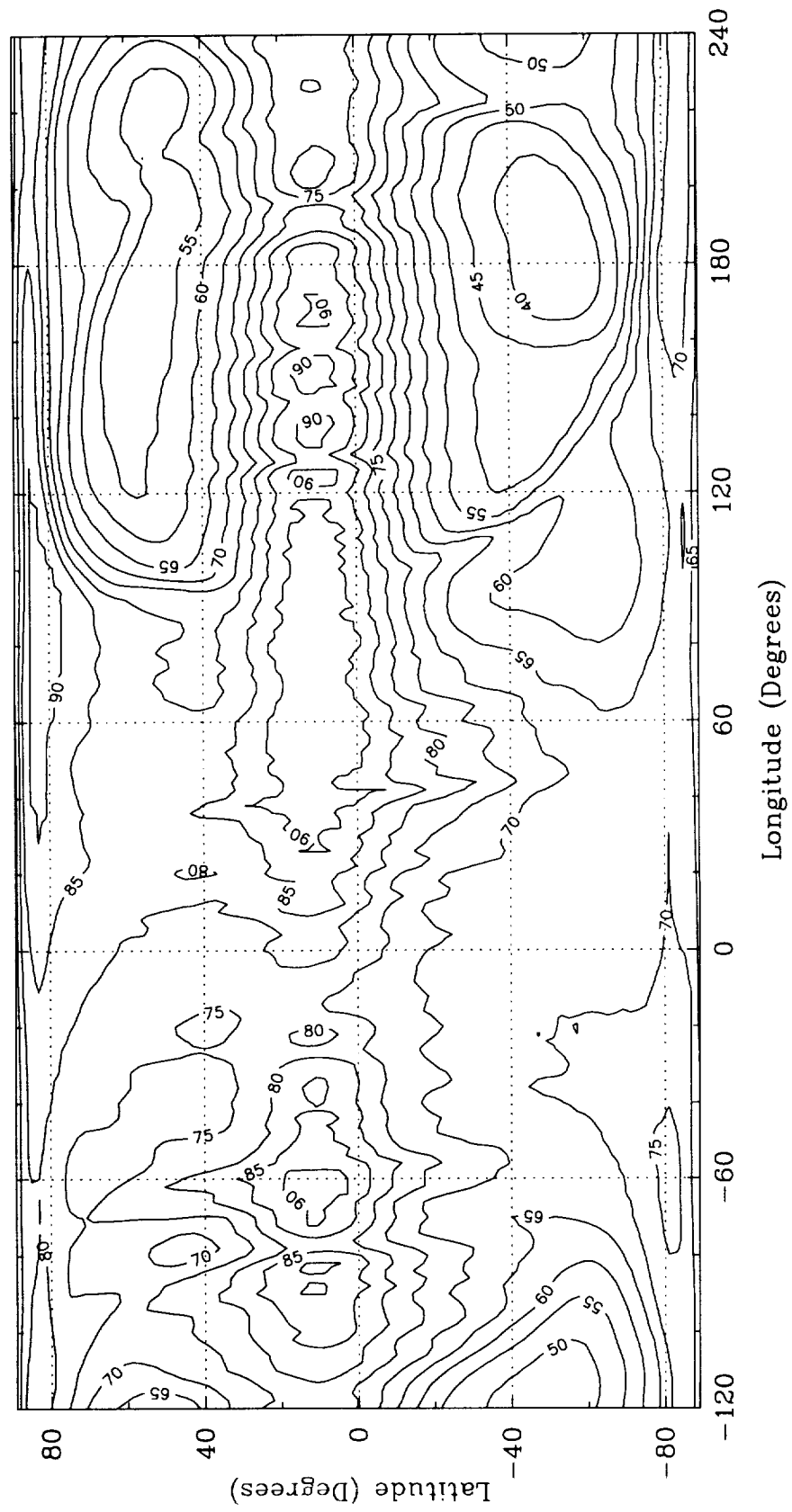
The uncertainty for the coefficients of degree  $n$ ,  $\sigma(a_n)$  is then given by the difference of the sum total error to degree  $n$  and the sum total error to degree  $n-1$  as

$$\sigma(a_n) = \sigma(a_{2,n}) - \sigma(a_{2,n-1}) \quad (9)$$

Figure 9 shows the expected acceleration profile from the Kaula rule of equation (6) and the unconstrained acceleration uncertainty profile as given by equation (9) for Atalanta, the periapse region for Magellan cycle 4 (e.g. eastern Eistla Regio), and the gap in Magellan cycle 5 data in the southern hemisphere (160°E to 220°E, 30°S to 80°S). The crossing point of the Kaula signal with the acceleration uncertainty is called the degree strength of the gravity field for that particular latitude and longitude. For degrees greater than the degree strength, the "noise" in the data exceeds the "signal." Based upon the Kaula rule, the degree strengths for Atalanta, Eistla, and the southern gap are 55, 90, and 38, respectively. Figure 10 displays the degree strength on a global scale. The maximum degree strength is greater than harmonic degree 90 near the low-altitude periapse locations.

The basic idea of the gravity constraint method is to constrain the "noise" of the gravity field to zero with some uncertainty when the "noise" exceeds the "signal." The acceleration at the surface from all harmonic coefficients greater than or equal to the degree strength is constrained to zero with an uncertainty approximately equal to the expected signal at the degree strength. This amounts to generating observations over the entire

Figure 10: Degree Strength for MGNP90LSAAP



surface of the sphere based upon the degree strength at each latitude and longitude. An observation ( $a_{D,90}$ ) for degree strength  $D$  is

$$a_{D,90} = \frac{GM}{a_E^2} \sum_{n=D}^{90} \sum_{m=0}^n (n+1) \bar{P}_{nm}(\sin \phi) (\bar{C}_{nm} \cos m\lambda + \bar{S}_{nm} \sin m\lambda) \quad (10)$$

and the linearized observation equation is given by (Bierman, 1977)

$$z_i = \mathbf{A}_i \mathbf{x} + v_i$$

where  $z_i$  is the difference between the observed value (zero in this case) and the nominal value of the observation (the accumulated acceleration at the surface for degrees  $D$  to  $90$  from the a priori gravity model as given by equation (10)),  $\mathbf{A}_i$  is the row vector of observation partials (the partial of the observation with respect to all the parameters being estimated),  $\mathbf{x}$  is the vector of estimated parameters (differences in the gravity coefficients from the nominal gravity model), and  $v_i$  is the observation error. The partials  $\mathbf{A}_i$  to construct the observation equation are

$$\mathbf{A}_i = \frac{\partial a_{D,90}}{\partial \mathbf{G}}$$

where  $\mathbf{G}$  is the vector of all gravity coefficients. The elements of  $\mathbf{A}_i$  for coefficients with degrees less than the degree strength  $D$  are zero and, otherwise, are again given by the partials of equation (8).

The observations are then merged with the unconstrained gravity SRIF array using Householder transformations. In normal form, the constrained gravity estimate  $\mathbf{x}$  is written as

$$\mathbf{x} = [\mathbf{P}_{\text{noap}}^{-1} + \mathbf{A}^T \mathbf{W} \mathbf{A}]^{-1} [\mathbf{P}_{\text{noap}}^{-1} \mathbf{x}_{\text{noap}} + \mathbf{A}^T \mathbf{W} \mathbf{z}] \quad (11)$$

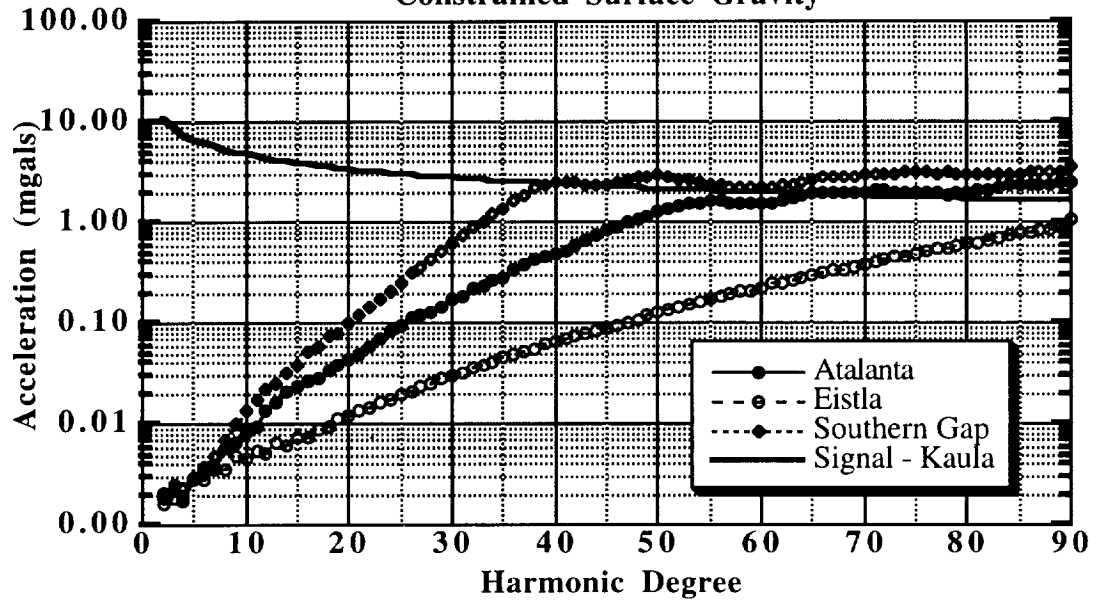
where  $\mathbf{P}_{\text{noap}}$  is the unconstrained covariance of the gravity coefficients,  $\mathbf{A}$  is the matrix of observation partials with each row an observation,  $\mathbf{W}$  is the diagonal weight matrix,  $\mathbf{x}_{\text{noap}}$  is the unconstrained gravity estimate, and  $\mathbf{z}$  is the vector of linearized observations. The new constrained covariance  $\mathbf{P}$  is then

$$\mathbf{P} = [\mathbf{P}_{\text{noap}}^{-1} + \mathbf{A}^T \mathbf{W} \mathbf{A}]^{-1} \quad (12)$$

The observations should be spaced such that at least three observations are generated over the shortest harmonic wavelength. The weight used for an observation is then proportional to the area between observations and is approximately equal to the signal at the degree strength (i.e., 10 to 20 milligals). The observations are globally spaced on a rectangular grid of latitude and longitude with a spacing of two degrees. To obtain truer peak values, there is no constraint around Maxwell Montes, Maat Mons, and Eistla and Beta Regio.

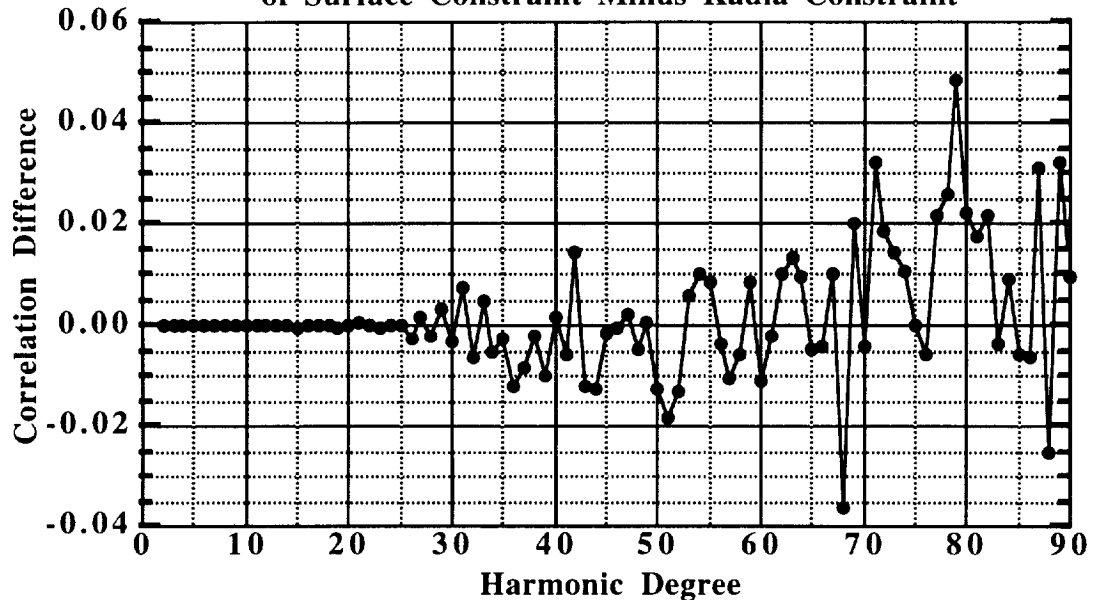
The result on the acceleration uncertainty profiles from applying the a priori observations on the gravity field is displayed in Figure 11 for the MGNP90LSAAP gravity

**Figure 11: Acceleration Profiles for Venus  
Constrained Surface Gravity**



field. The result for Atalanta and the Southern gap is an approximate Kaula constraint on the "noise" part of the spectrum. The uncertainties in the lower degree harmonics (up to degree 10) are one to two orders of magnitude greater for the unconstrained case (Figure 9)

**Figure 12: Gravity Correlation with Topography  
of Surface Constraint Minus Kaula Constraint**



versus the constrained (Figure 11). This is due to the lack of any constraint on the estimated parameters that are not gravity harmonics (Venus ephemeris, pole, and Love number) and is not due to the constraint on the higher degree coefficients.

The main advantage of using this spatial constraint instead of a straight Kaula rule on the spectrum appears to be better determination of peak amplitudes. Since the well determined degrees are not constrained directly (only somewhat through correlations), the amplitudes (and coefficients) for those degrees are not biased toward zero. It is also flexible in allowing relaxation of selected regions for any reason, such as incorrect data weighting or a region exhibiting greater signal than the power rule. The amplitudes are reduced by about 5 to 10% when a Kaula power law is applied versus the spatial constraint (e.g., 10 milligals for Maxwell Montes and Gula Mons, and 35 milligals for Maat Mons). The correlations with topography for the two different constraint methods are very similar. The correlations from the Kaula constraint are generally slightly higher for the medium wavelength harmonics and slightly lower for the higher frequencies (see Figure 12) with the sum of correlations over the degrees in favor of the surface constraint. In general, there are only slight differences between the methods since Venus does not have strong local deviations from Kaula power spectrum. For Mars, the differences are more pronounced for the Tharsis region (Konopliv and Sjogren, 1995a).

## 5. Gravity Results

### *5a. Global Gravity Model*

The normalized coefficients of the nominal gravity solution (MGNP90LSAAP, SAAP = Surface Acceleration A Priori) are given in Appendix G up to degree and order 40. A file containing the complete field to degree and order 90 can be requested from the authors at ask@krait.jpl.nasa.gov or obtained from the Geoscience Node of the PDS at Washington University in St. Louis, Missouri (in the format specified by Simpson, 1993a). Also available from the Data Node are the covariance of the gravity harmonics (a 275 MB binary file, Simpson, 1993b), vertical surface gravity and error map (Simpson, 1995b), geoid and error map (Simpson, 1995b), and Bouguer map (Simpson, 1995b).

The GM solutions for Venus are given in Table 4 for different combinations of data. The 40th degree solutions are generated by fixing the coefficients from degree 41 to 90 at the values of the nominal gravity field (MGNP90KSAAP). The 40th degree solutions allow the Venus pole and rotation rate to move (i.e., they are estimated) and the 90th degree solutions hold the pole and rate to the nominal 1991 IAU values. The variations in the GM solution are generally one formal sigma with almost a two-sigma variation for the Magellan Cycle 4 data. The best GM solution with a realistic error is  $324858.601 \pm 0.014 \text{ km}^3/\text{s}^2$  (2 x formal uncertainty). This solution agrees with our previous solutions within about two formal uncertainties. The ionosphere calibrations play a major role in the determination of the Venus GM from the PVO data, and their neglect may be a reason for unrealistically large values of previous solutions (our PVO solution without ionosphere calibrations jumps to about 324858.65).

Table 4. Gravitational Constant Times the Mass of Venus (GM in km<sup>3</sup>/s<sup>2</sup>).

Data Combination	Constraints	Solution	Formal Uncertainty
PVO	40, K, lp	324858.576	0.017
MGN Cycle 4	40, K, lp	324858.654	0.027
MGN Cycle 5	40, K, lp	324858.600	0.011
PVO+ MGN Cycle 4	40, K, lp	324858.589	0.011
ALL	40, K, lp	324858.600	0.007
PVO	90, K, lp	324858.581	0.018
MGN Cycle 4	90, K, lp	324858.649	0.028
MGN Cycle 5	90, K, lp	324858.605	0.011
PVO+ MGN Cycle 4	90, K, lp	324858.587	0.011
ALL	90, K, lp	324858.601	0.007
ALL (MGNP90LSAAP)	90, S, fp	324858.601	0.007

90, 40 = degree and order of solution, K = Kaula rule, S = Spatial (SAAP)  
fp = fixed IAU pole, lp = loose pole (estimated pole and rotation rate for Venus)

*Previous Solutions:*

Sjogren et al, 1990 (PVO Only)	324858.60	0.05
Nerem et al, 1993 (PVO Only)	324858.64	0.01
McNamee et al, 1993	324858.681	0.03
Konopliv et al 1994a, MGNP60FSAAP	324858.628	0.016
Konopliv et al, 1994b, MGNP75ISAAP	324858.589	0.006

The vertical (or radial) gravity at the reference surface (a sphere of 6051 km) is displayed in Figure 13 with contours every 20 milligals (10<sup>-8</sup> km/s<sup>2</sup>). The radial gravity is given by the partial of the potential, equation (1), in the radial direction without the central mass term but including J<sub>2</sub>. A sphere is used as the reference surface for Venus since J<sub>2</sub> is small for Venus and comparable in size to the other spherical harmonics. The geoid or equipotential surface of equation (1) is given in Figure 14 with contours every 10 meters. The rotational contribution to the potential is neglected for Venus and the geoid is iterated to convergence. The difference between one and two iterations on the geoid or the error in Bruns' formula (Heiskanen and Moritz, 1967) is at most 3 cm in Atla and Beta Regio out of a 100+ meter geoid value.

The uncertainties in the vertical gravity and geoid are given in Figures 15 and 16. The uncertainties in the surface acceleration or potential are given by the errors up to the resolution or degree strength of the data plus the error for omission of terms beyond the resolution. From Figure 11, the uncertainties from the higher order terms (> degree strength) generally follow the Kaula power rule. So Figures 15 and 16 provide realistic errors for terms up to degree and order 90. Figure 17 shows the error in the vertical gravity up to the degree strength (i.e., the unconstrained covariance **P**<sub>noap</sub> is truncated at the degree strength for that given latitude and longitude). The error in the gravity field that the data can



Figure 13: Vertical Gravity of Venus at the Surface (mgals)

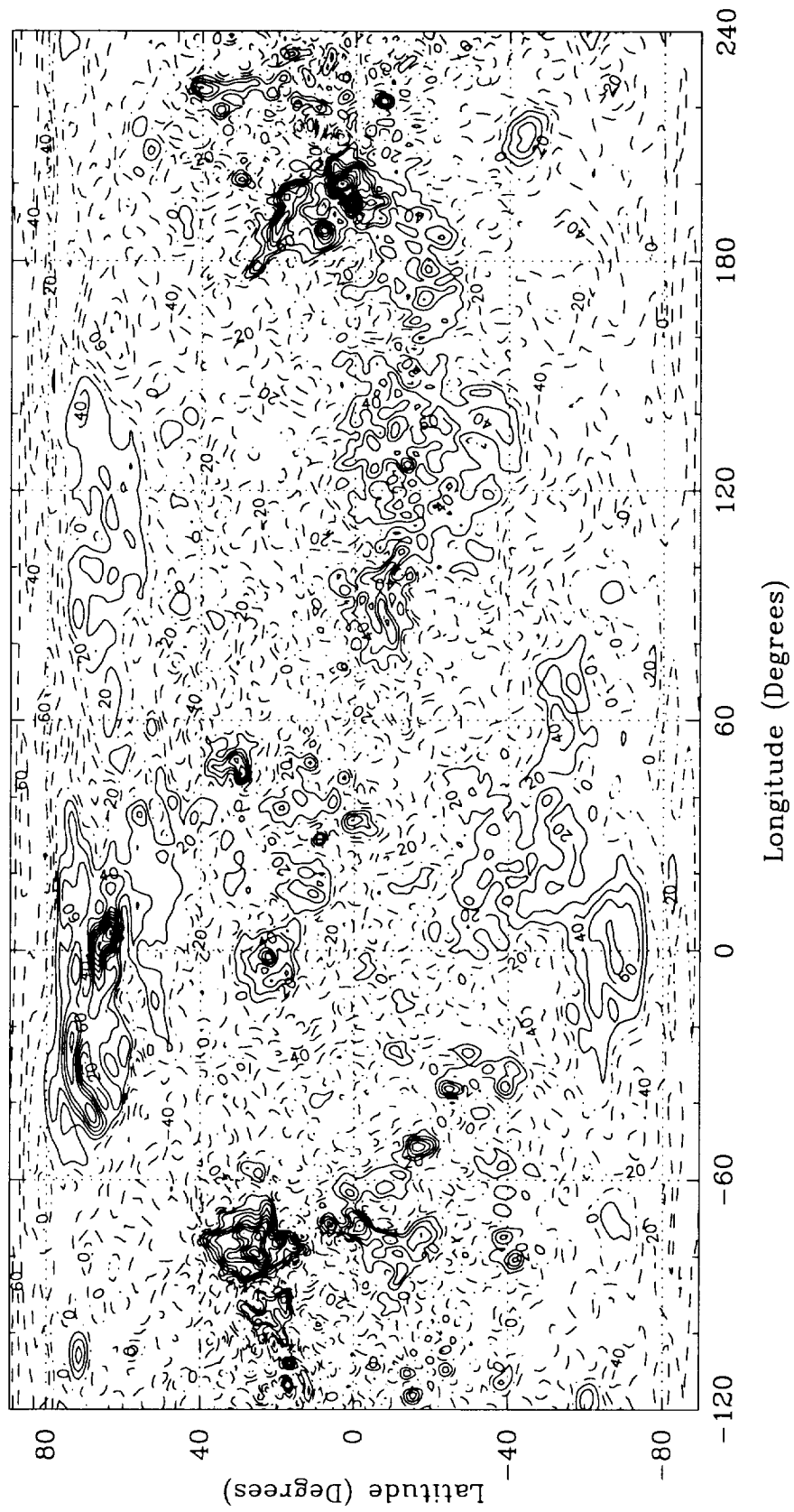


Figure 14: Geoid of Venus (meters)

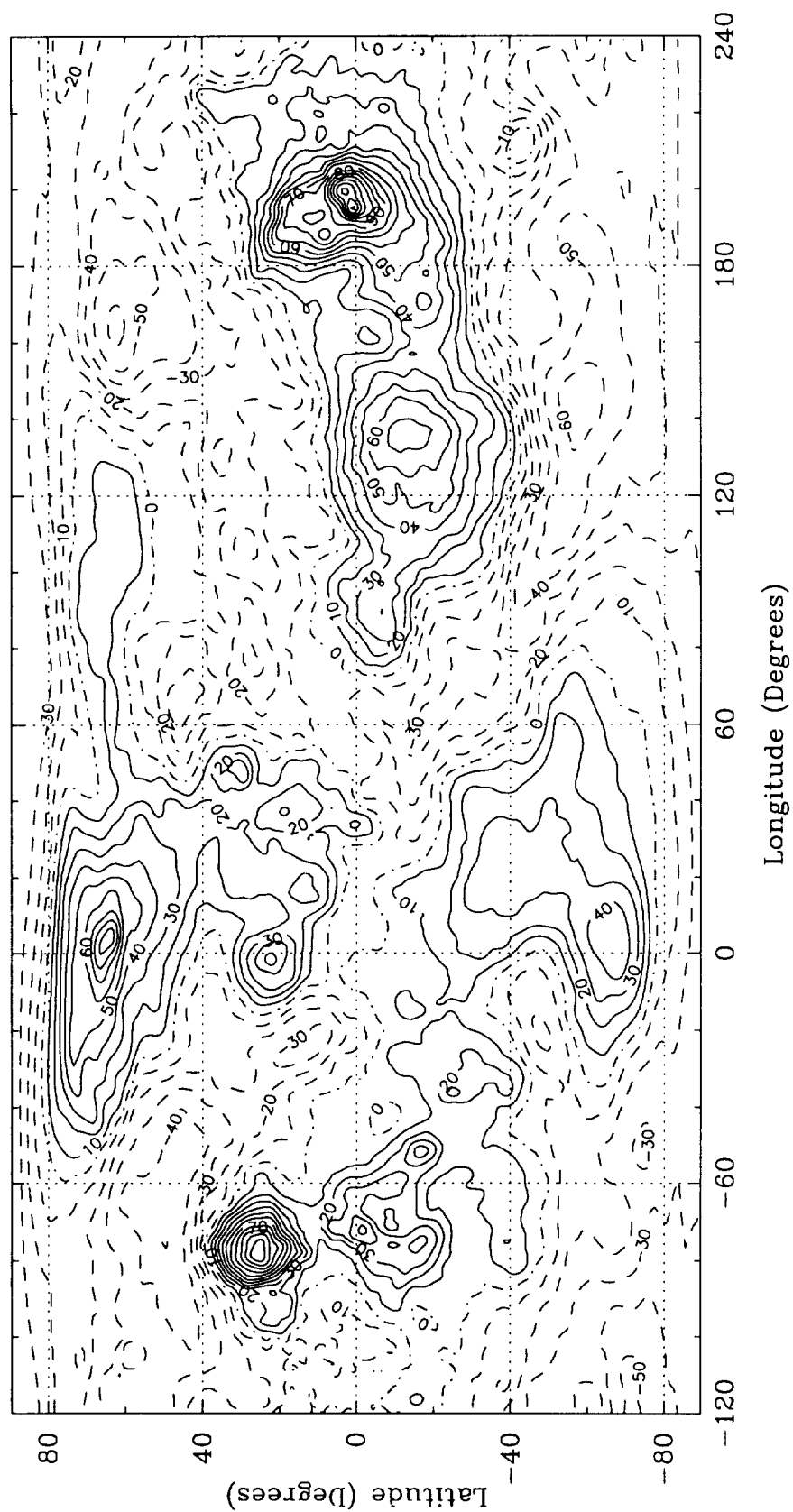


Figure 15: Vertical Gravity Uncertainty at the Surface (mgals)

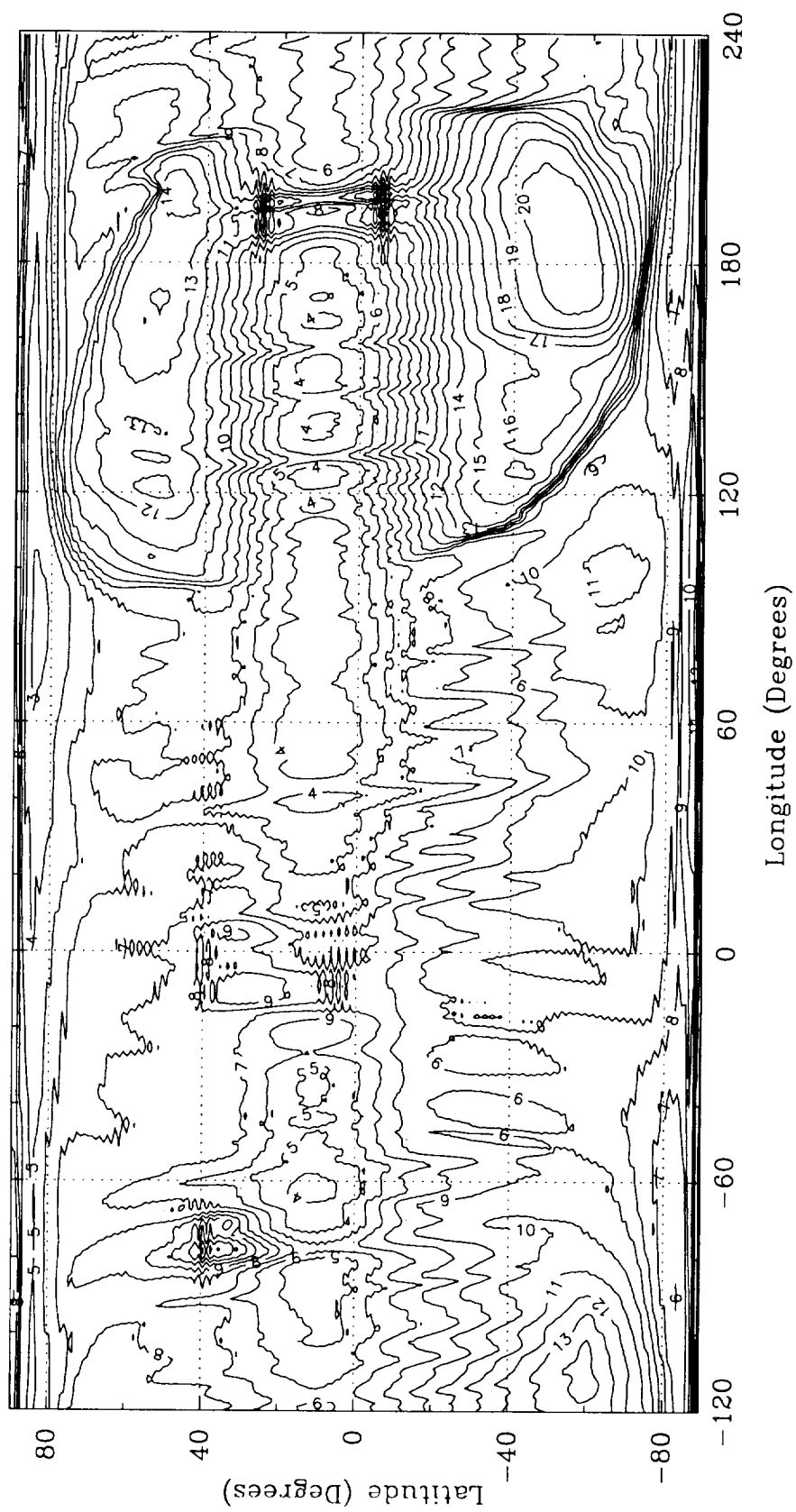


Figure 16: Venus Geoid Uncertainty (meters)

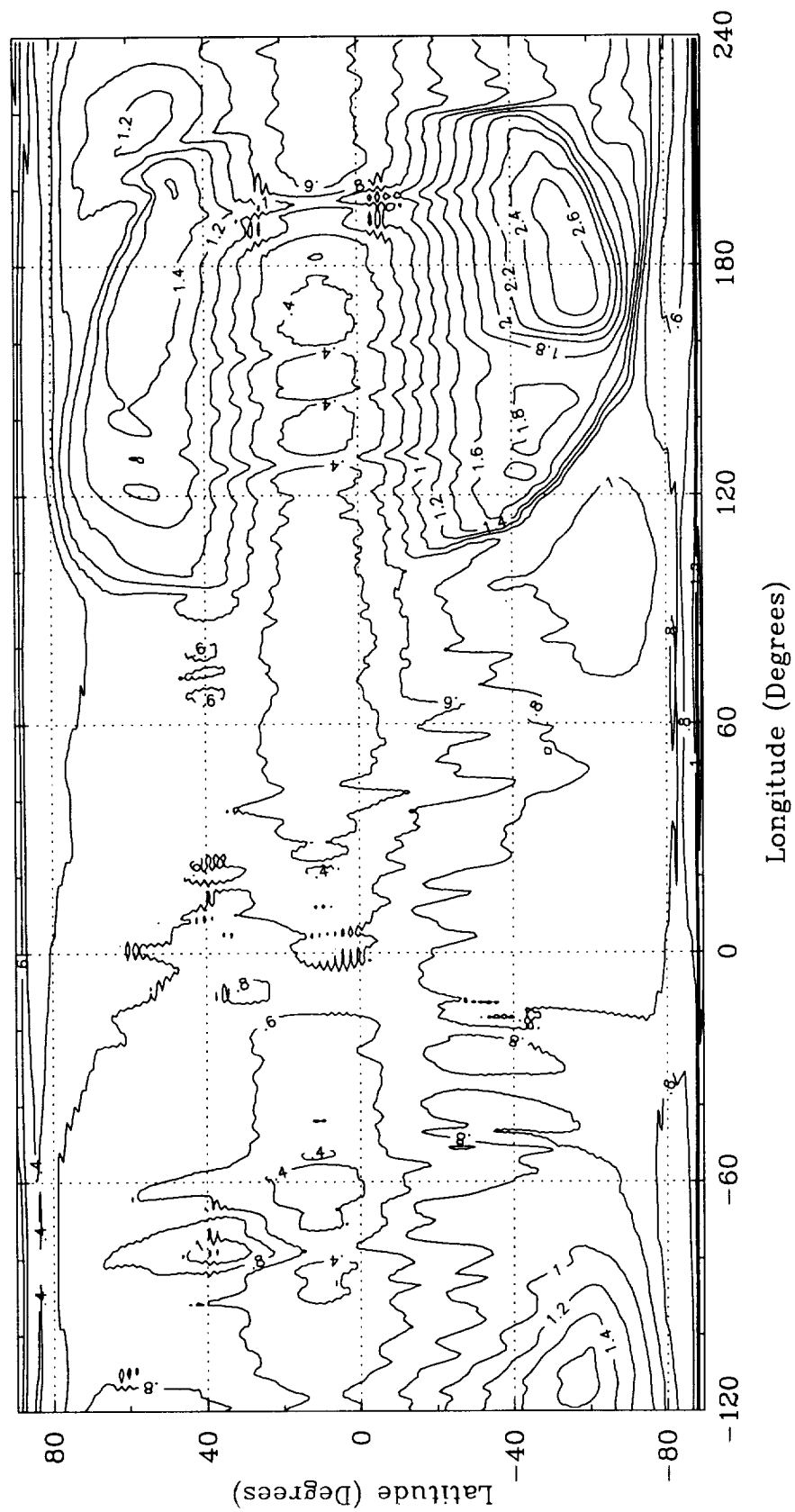


Table 5. Gravity Peaks for Venusian Features of Interest

Feature	Lon	Lat	MGNP90LSAAP	MGNP75ISAAP	MGNP60FSAAP
Maxwell	4.5	63.5	244.68	220.65	184.30
Akna	-42.5	68.5	115.17	99.57	75.52
Freya	-23.5	73.5	126.34	123.98	105.51
Bell	46.0	29.0	126.25	116.40	102.88
Beta	-79.0	25.5	234.32	231.82	211.87
Gula	-2.0	22.0	138.27	121.77	99.90
Maat	195.0	1.0	356.41	308.46	228.63
Ozza	200.0	3.5	245.52	250.75	224.63
Nokomis	190.0	19.5	132.89	136.44	124.42
Sapas	188.0	8.5	157.54	135.76	126.92
Atalanta	164.5	62.5	-84.44	-83.96	-78.34
Mead	57.2	12.6	-49.67	-39.71	-29.85

sense is globally uniform and equals about 4 to 5 milligals (the error for the sensed geoid is about 0.4 meters). After Magellan was aerobraked into a near circular orbit, there was no direct observation of the gravity field from about 160°E to 220°E, and these gaps are apparent in the uncertainty maps. The total errors (Figures 15 and 16) are largest for the southern gap in the Magellan post-aerobraking data since there the resolution is poorest and we have the greatest error from omission of higher degree terms. The largest vertical gravity and geoid errors are 20 milligals and 2.6 meters. Also visible in the error maps (and degree strength map - Figure 10), is the apoapse tracking in the cycle 5 Magellan data from about 100°E to 160°E. The face-on orbit geometry of Magellan cycle 4 data and the decrease in resolution is evident in Figure 10 near longitudes 0° and 240°E.

The degree strength map (Figure 10) can be verified by plotting the unconstrained solutions for different degree and order. The 90th degree and order solution without any gravity constraint is displayed in Figure 18 with the unconstrained solutions for degrees 75, 60, and 40 shown in Figures 19, 20, and 21, respectively. Again as in Table 4, the lower degree solutions are found by fixing the higher degree terms to the nominal gravity field (i.e. a truncation of the square root information array). The higher order coefficients (the last 5 to 10 degrees) show aliasing from signatures in the residuals due to terms with degree greater than 90. This shows up as noise in Figure 18. The 75th degree truncated solution, however, does not exhibit aliasing and is much cleaner than the unconstrained solution from MGNP75ISAAP. In general, the unconstrained solutions match the resolution map. The gravity field is completely determined to about degree and order 40 since no noise is visible in Figure 21.

The peak values of the vertical gravity for areas of interest are given in Table 5 for MGNP90LSAAP and the previous 75th degree and order solution (MGNP75ISAAP, Konopliv and Sjogren, 1994b) and 60th degree and order solution (MGNP60FSAAP, Konopliv and Sjogren, 1994a). All are maximum peak values except for the gravity lows of Atalanta and Mead Crater. The strongest gravity feature on Venus is Maat Mons, which will continue to increase in amplitude with the increasing higher degree and order gravity solutions (the next solution will be to degree and order 120). The 90th degree postfit Doppler residuals still show substantial systematic trends from the gravity for the Atla and Beta Regios. The peaks of Bell Regio show noticeable increase and also better alignment

Figure 17: Vertical Gravity Error to the Degree Strength

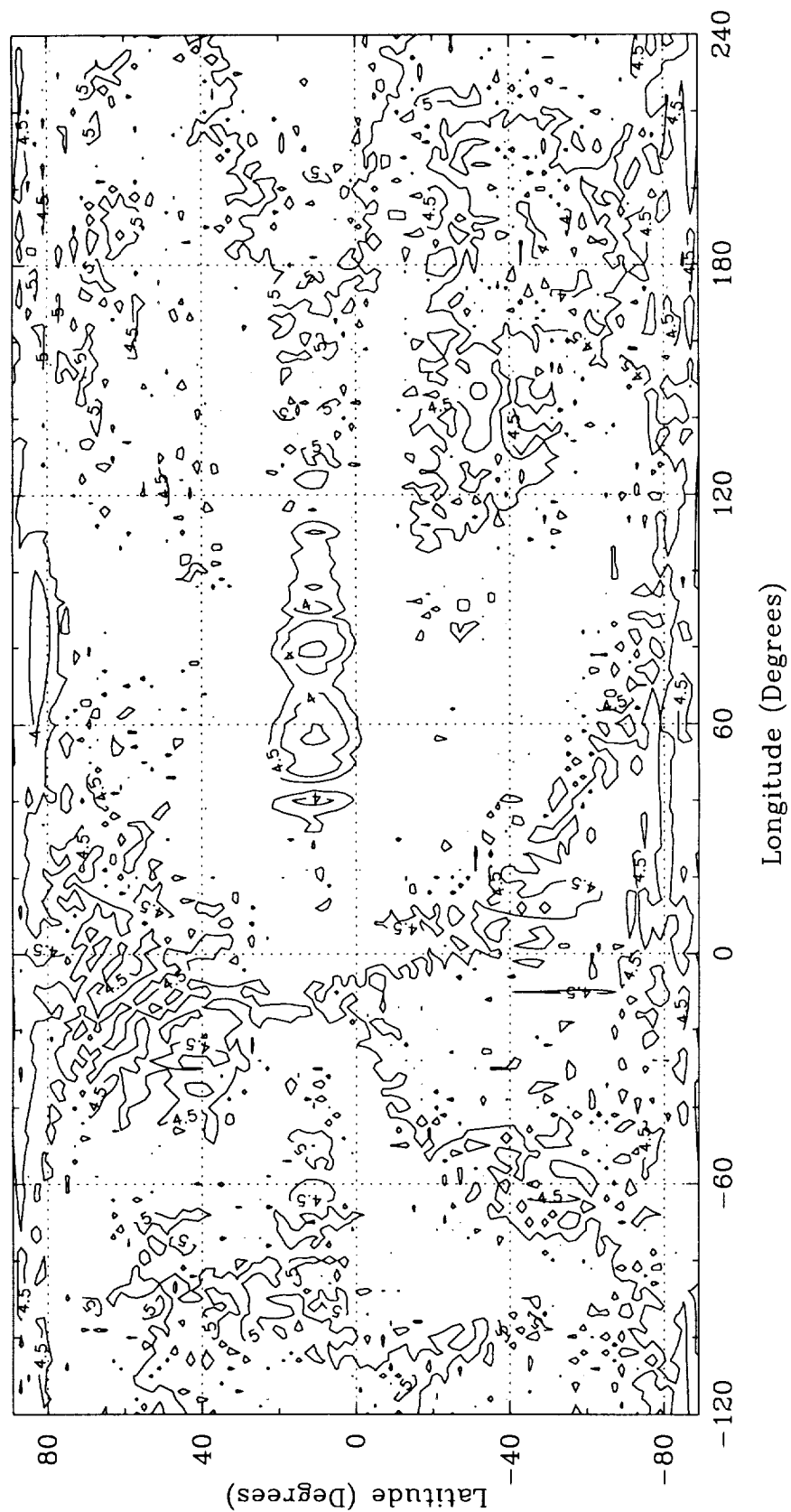


Figure 18: Unconstrained Vertical Gravity (mgals), Degree = 90

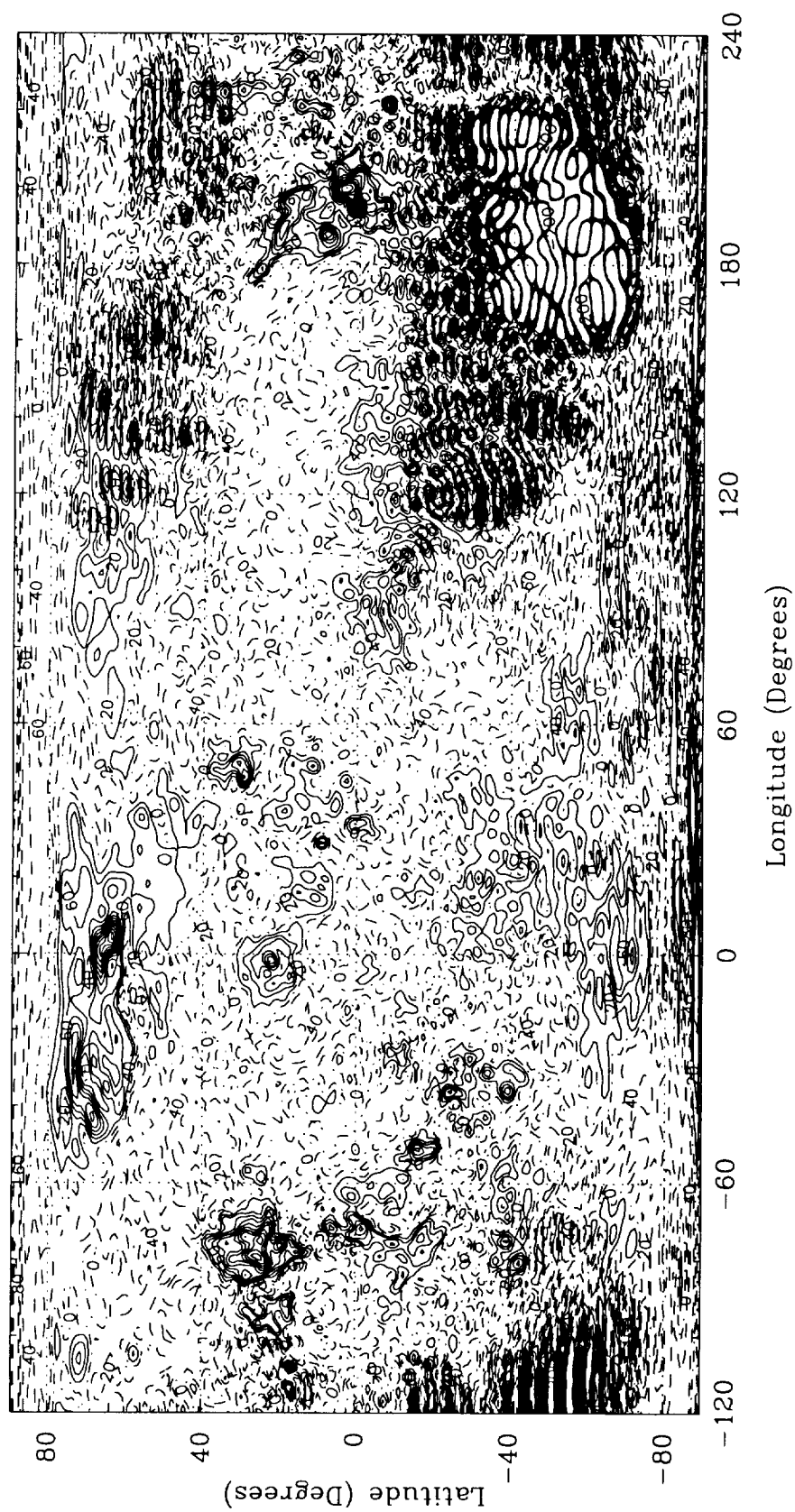


Figure 19: Unconstrained Vertical Gravity (mgals), Degree = 75

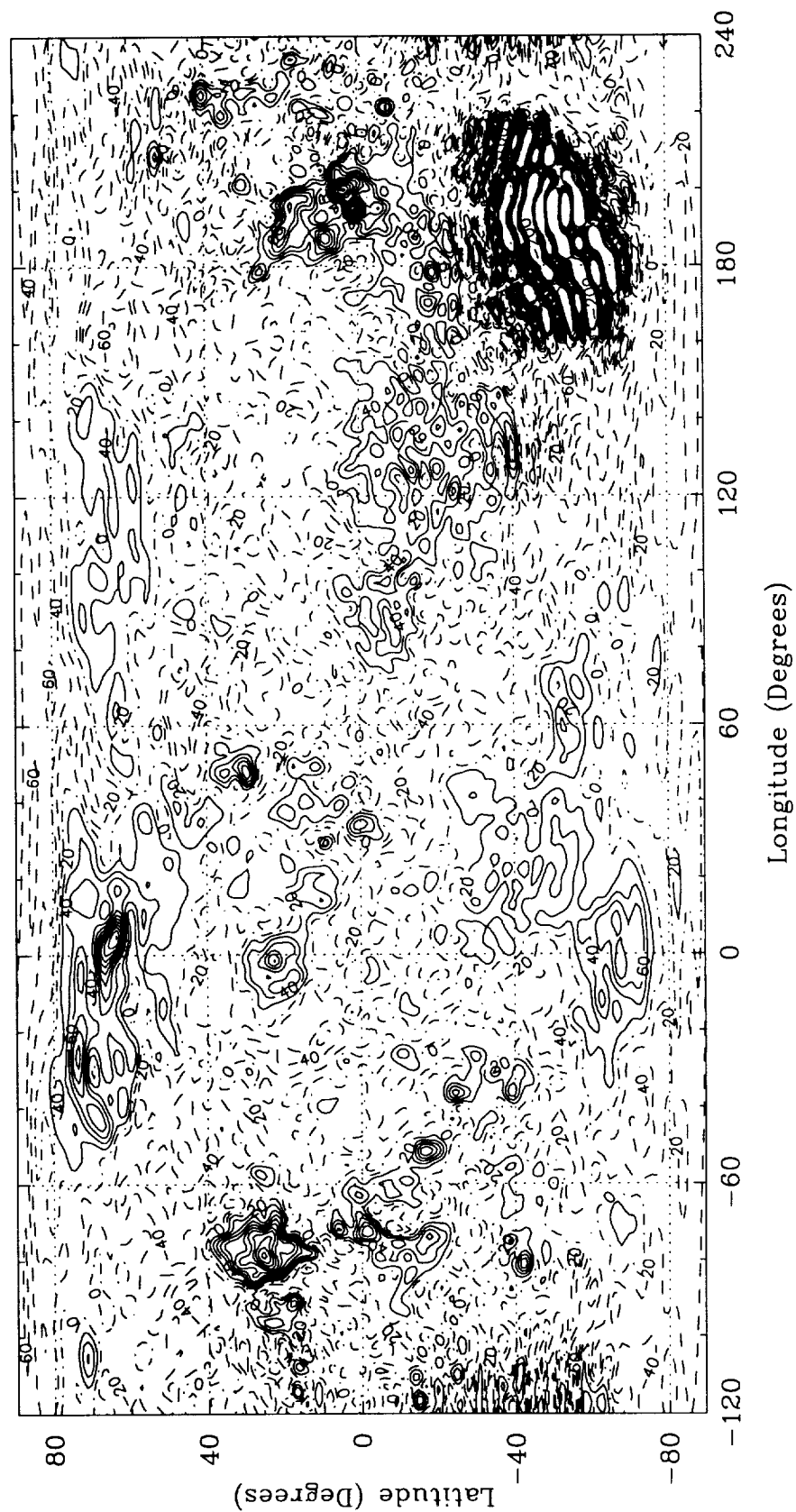




Figure 20: Unconstrained Vertical Gravity (mgals), Degree = 60

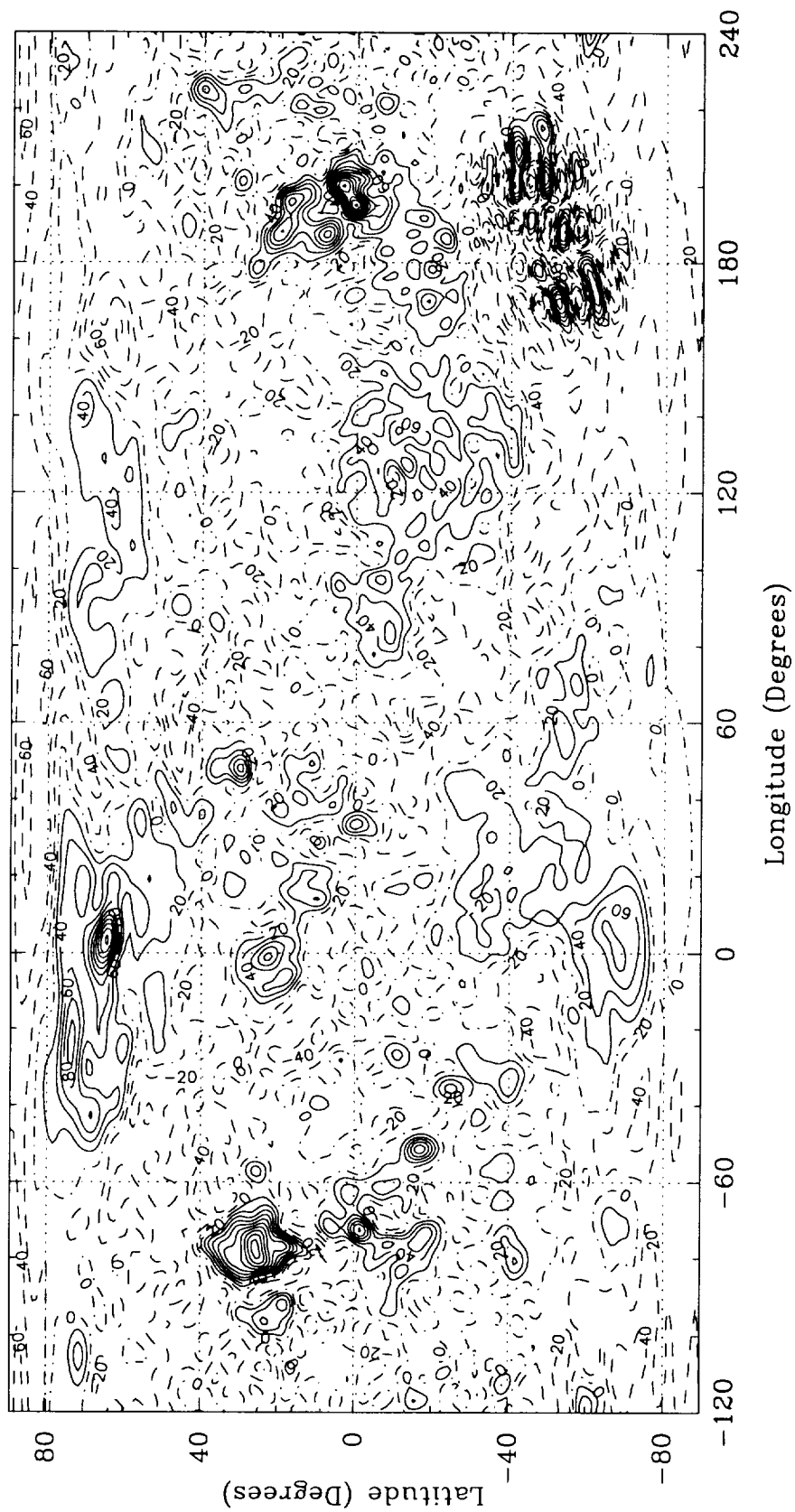


Figure 21: Unconstrained Vertical Gravity (mgals), Degree = 40

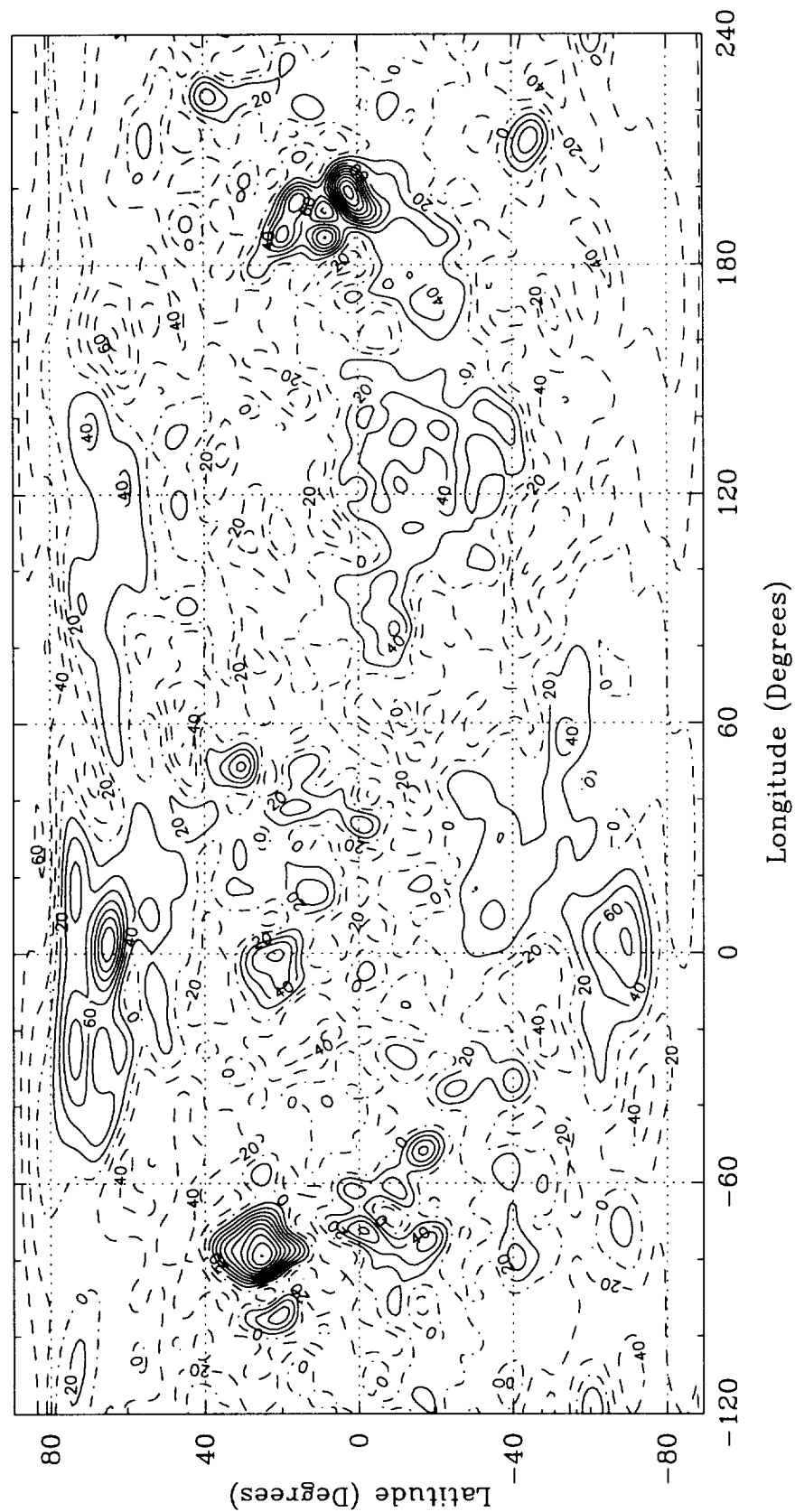


Table 6. Comparisons of Spherical Harmonics with Line-of-Sight Reductions (mgals)

Feature		Reference Altitude (km)			Comments
<u>Beta</u>	<u>Surface</u>	<u>187</u>	<u>200</u>	<u>250</u>	
Konopliv	234	131	128	114	
Kaula (1995)	240				2% high
McKenzie (1995)		90			31% low
Sjogren (1983)			73		43% low
Esposito (1982)			135		5% high
Smrekar (1994)				85	25% low
<u>Maxwell</u>	<u>Surface</u>	<u>323</u>			
Konopliv	245	68			
Kaula (1995)	200				18% low
McKenzie (1995)		39			42% low
<u>Maat</u>	<u>260</u>				
Konopliv	106				
Sjogren (1983)	64				40% low
Smrekar (1994)	75				29% low
<u>Gula</u>	<u>Surface</u>	<u>180</u>	<u>202</u>		
Konopliv	138	61	57		
Sjogren (1983)		38			34% low
Barriot (1994)	110				20% low
McKenzie (1995)			40		30% low
Smrekar (1994)			50		12% low

with the topographic highs. Appendix I contains plots of vertical gravity for different regions of Venus for MGNP90LSAAP.

A comment, which was mentioned by Sjogren (1984) when discussing his analysis of Ishtar, was that there was a need to have a positive mass placed at 51.5° N so that the acceleration profile could be fit. This gravity anomaly is now definitely revealed (see Appendix I).

A comparison of what other analysts have obtained for some of these features is shown in Table 6. They have used the line-of-sight accelerations derived from Doppler residuals and produced local estimates (all except Esposito et al, 1982, who used the raw Doppler observations and surface mass disks to estimate the Beta gravity anomaly). Most line-of-sight estimates were obtained at different reference altitudes and therefore the harmonic estimates were evaluated at those altitudes to make comparisons valid. Except for the Beta estimate of Kaula (1995, 240 versus 234 mgals), all estimates are lower than the harmonic estimates by considerable amounts. This is rather surprising since the Doppler residuals should contain the very highest resolution of the data. On the other hand, the harmonics at degree 90 leave almost no systematic signature in their residuals. An explanation for this variance may be due to the model fitting to the LOS data. The

experimenters must decide on optimum block sizes or mass distributions. The data are then smoothed to avoid singularities at the surface which may reduce the amplitudes. Also, there may be amplitude reductions as a result of a larger than needed spline interval for determination of the accelerations from the Doppler residuals.

Mead was the subject of previous investigation (Banerdt et al, 1994) with a 60th degree and order gravity field. The amplitude for Mead with that model was -30 mgals with the gravity anomaly being slightly offset by about one degree from the center of the crater. The higher resolution 90th degree models show almost perfect alignment with the crater and substantially increased amplitudes, and show further confirmation that Mead is indeed mostly uncompensated (even less than the 30% maximum reported by Banerdt et al, 1994). For terms up to 90th degree, the gravity signature at the surface from uncompensated topography of Mead only and not the surrounding topography is -25.1 mgals (for up to degrees 60 and 75, the amplitudes are -9.8 and -16.7 mgals, respectively). The spherical harmonic topography model was determined by Nicole Rappaport with data from Bob Grimm and zeros out all topography except Mead. The model was determined to degree and order 120 but is truncated for comparison with the gravity. The corresponding gravity signature from Mead is also at least -25 mgals with respect to the surrounding gravity and maybe even 5 to 10 mgals larger. From degree 60 to 90, the uncompensated gravity from topography increased by 15.3 mgals and the observed gravity increases by 19.8 mgals (i.e. from Table 5). With a crust thickness of 25 and 50 km and 30% compensated, the gravity minimum from topography is -19.3 and -20.7 mgals, respectively. For the high degree terms, the uncertainty in the gravity is better than the 4 mgal formal error, and, hence, we can now say Mead is even less than 30% compensated.

The rms magnitude of the gravity spectrum for degree  $n$  ( $M_n$ ) is given by  $M_n = G_n/(2n+1)^{1/2}$  where  $G_n$  is the magnitude of all the gravity coefficients of degree  $n$  (given by the vector  $\mathbf{G}_n$ ). The spectrum for MGNP90LSAAP along with the uncertainties and Kaula power rule for Venus is shown in Figure 22. Also shown is the spectrum from the unconstrained gravity solution (90lnoap or no a priori). In this case there is the same constraint on the nongravity parameters (ephemeris, pole, etc.) as MGNP90LSAAP and one can notice that the constraint on the higher degree coefficients does not affect the formal uncertainties on the lower degree coefficients (at least  $<$  degree 10, note Figures 9 and 11 show the effect of not constraining pole, etc.). From Figure 22, one can say that the gravity field is determined over the entire surface to about degree and order 40 (the crossing point of the unconstrained sigma and the Kaula power rule).

For Venus, probably the best test for evaluation of the gravity field has been the correlation with topography. As more tracking data were added to the solution and as modeling improved, the correlation with topography continued to show higher values. Figure 23 shows the correlation for MGNP90LSAAP along with the error bars. With  $\mathbf{T}_n$  being the vector of all topography coefficients for degree  $n$ , the correlation for degree  $n$  is given by  $\gamma_n = (\mathbf{G}_n \cdot \mathbf{T}_n) / (G_n T_n)$ . The topography coefficients are given by the 360th degree and order model of Rappaport and Plaut (1994). The correlation error bars in Figure 23 for each degree ( $\sigma\gamma_n$ ) are contributions from the gravity covariance and are given by  $\sigma\gamma_n^2 = \mathbf{A}_n^T \mathbf{P}_n \mathbf{A}_n$  where the matrix  $\mathbf{P}_n$  is the sub-covariance with the degree  $n$  terms ( $\mathbf{G}_n$ ) only of the full covariance matrix of MGNP90LSAAP. The vector  $\mathbf{A}_n$  is the partial of the correlation for degree  $n$  ( $\gamma_n$ ) with respect to the gravity coefficients of degree  $n$ ,  $\mathbf{A}_n = (\mathbf{T}_n / G_n T_n) - \gamma_n (\mathbf{G}_n / G_n^2)$ . As mentioned in Konopliv et al (1994b), the uncertainties to

Figure 22: RMS Magnitude Gravity Spectrum

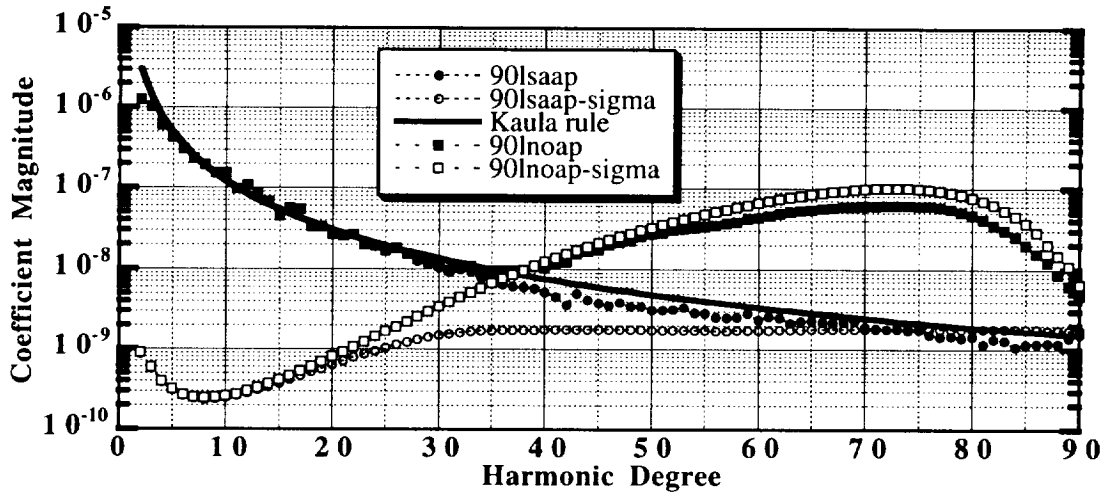


Figure 23: Correlation of Gravity with Topography and Error Bars

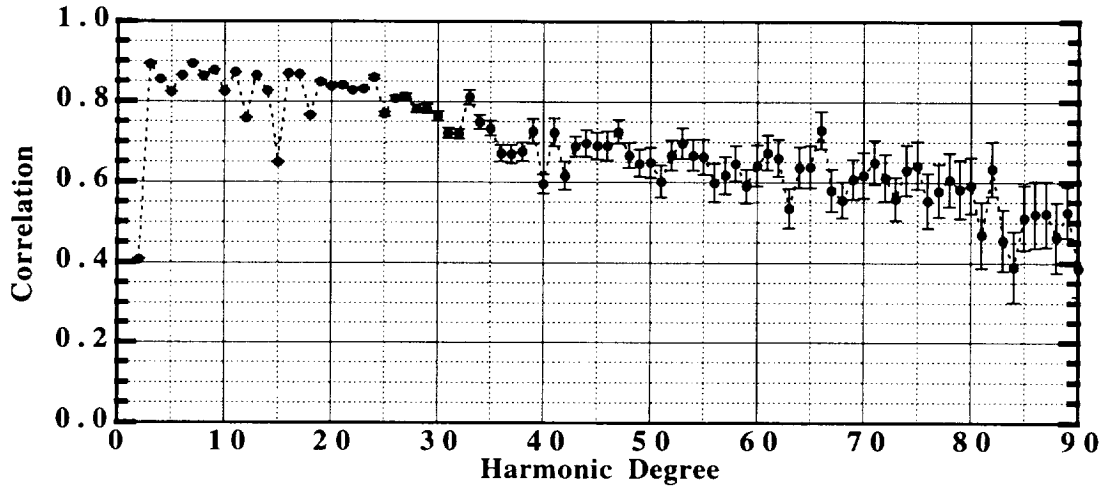


Figure 24: Comparison of Correlation with Topography for Gravity Solutions

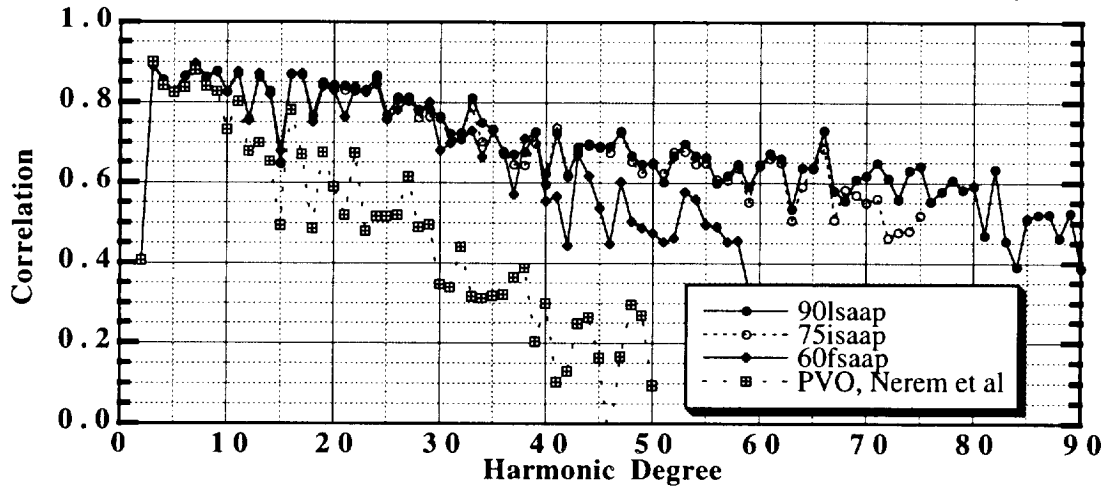


Figure 25: Correlation with Topography for  $N=2$  to 10

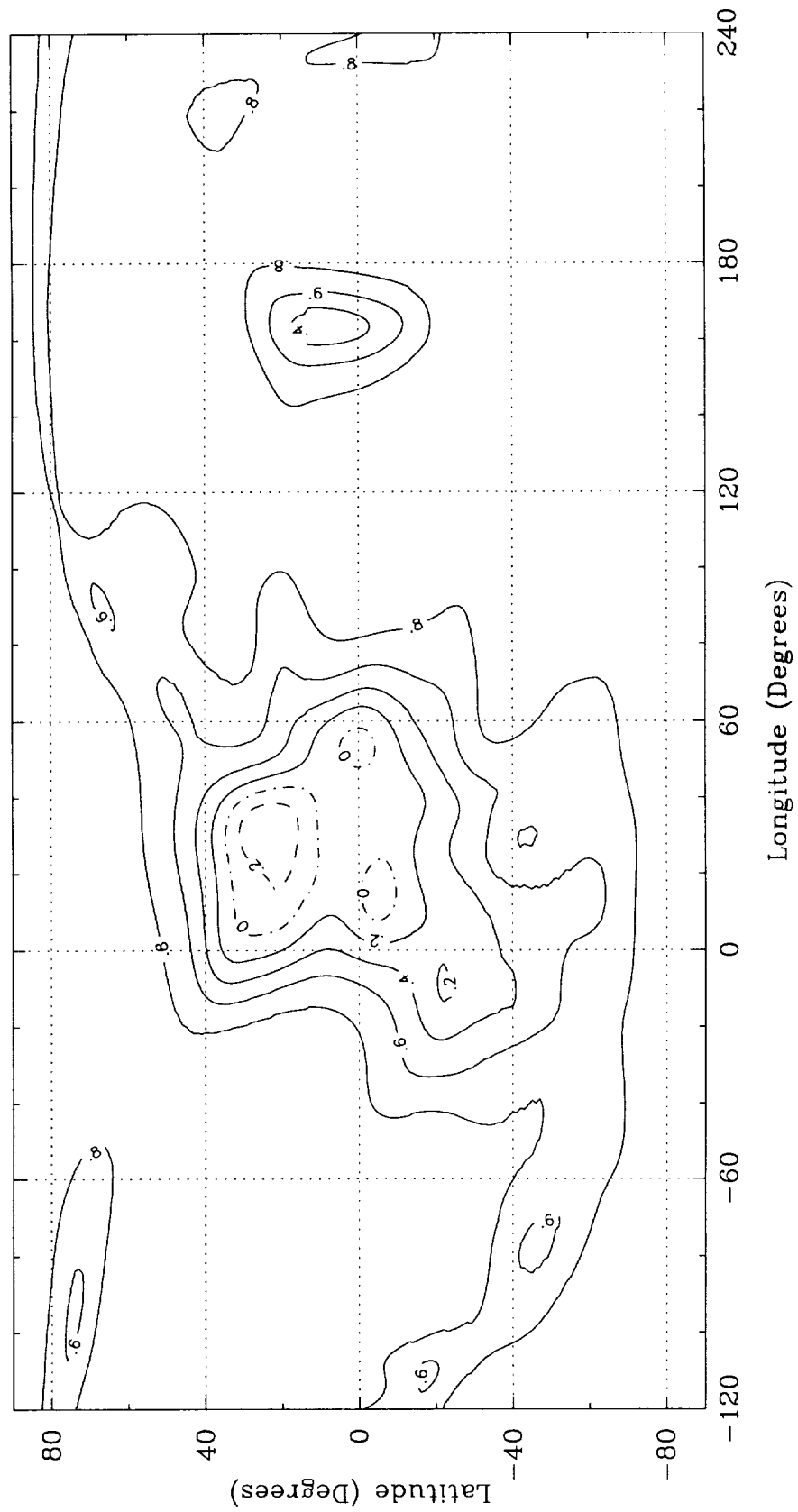


Figure 26: Correlation with Topography for N=11 to 20

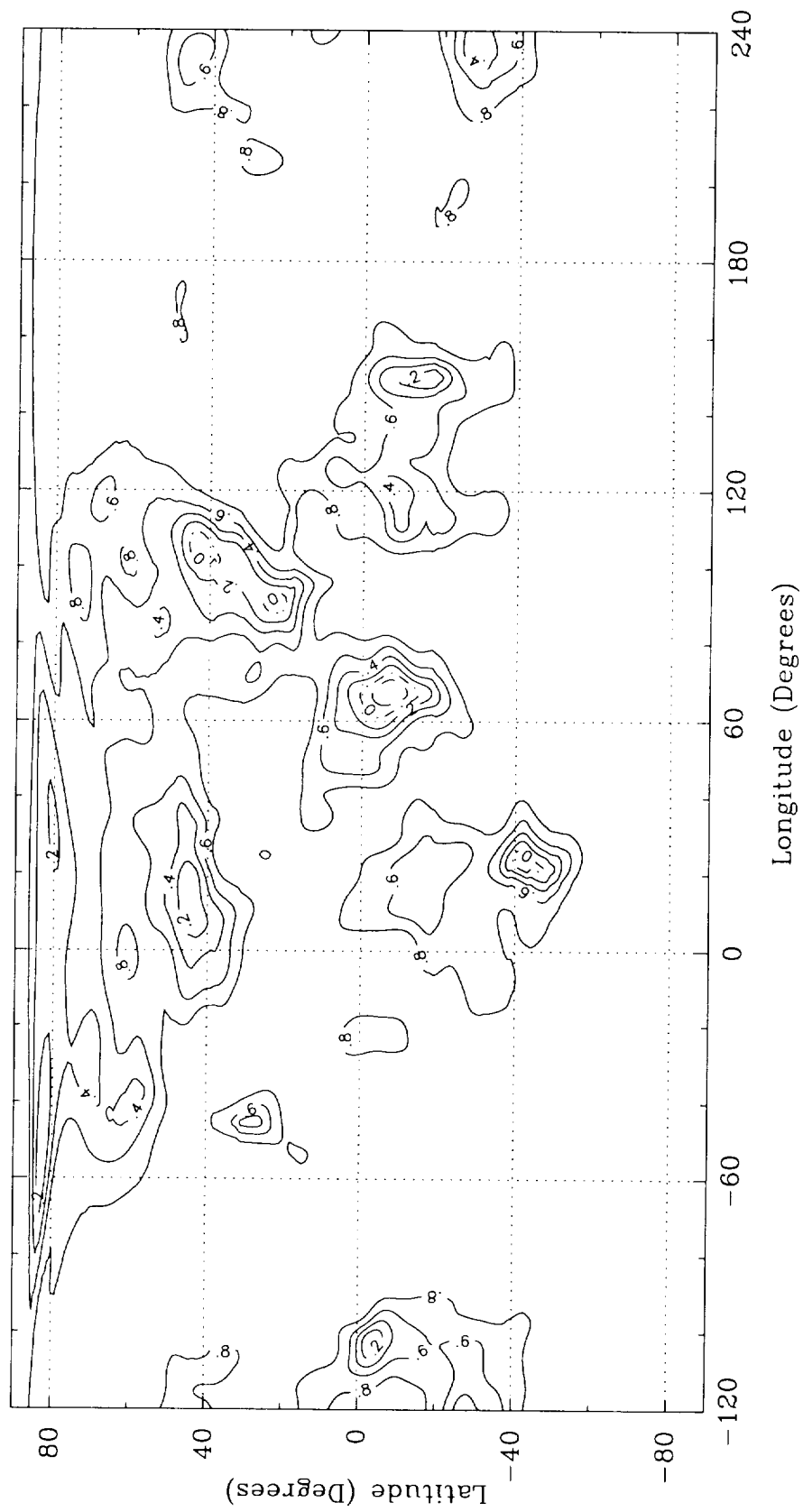


Figure 27: Correlation with Topography for N=21 to 30

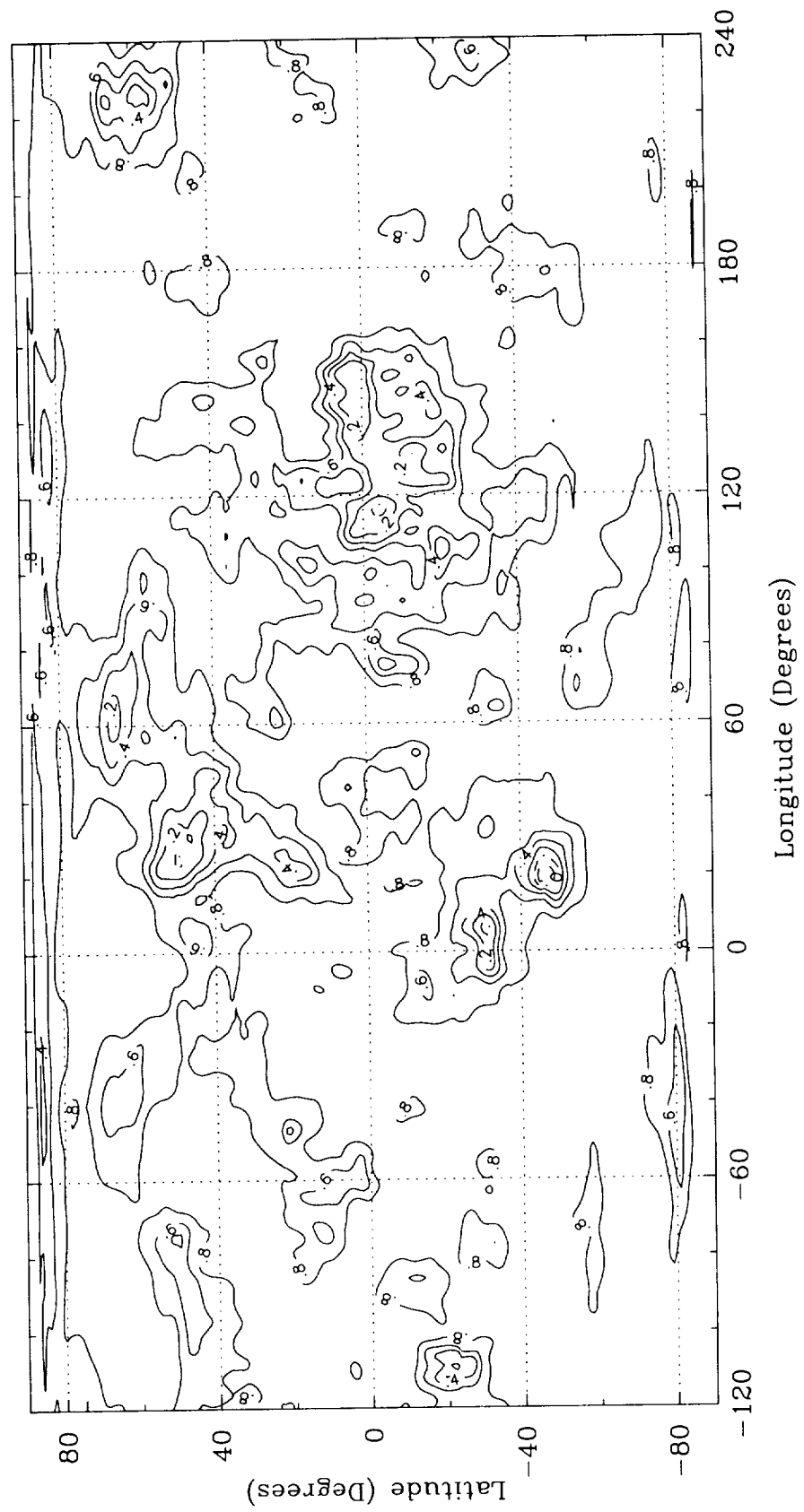
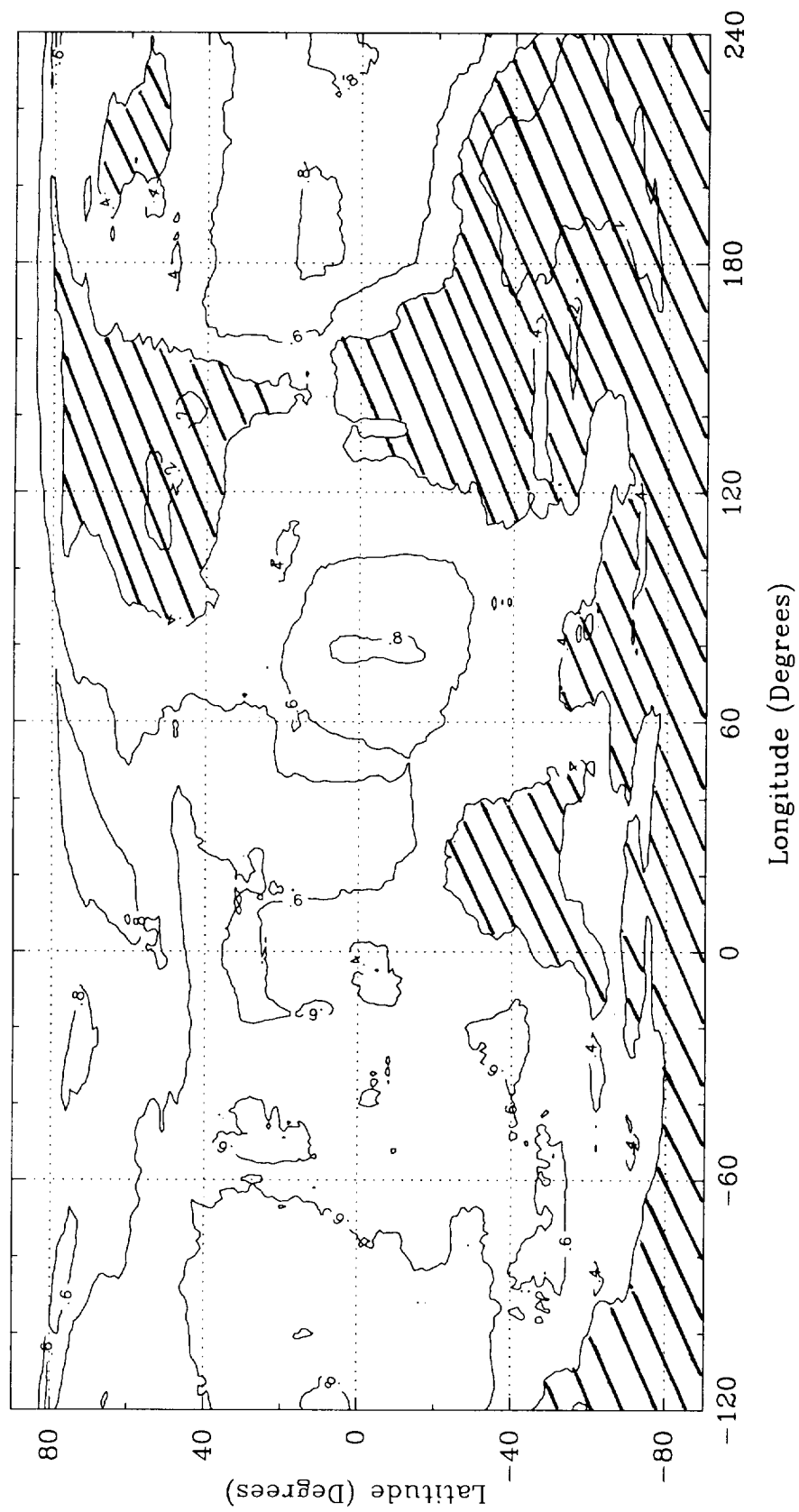
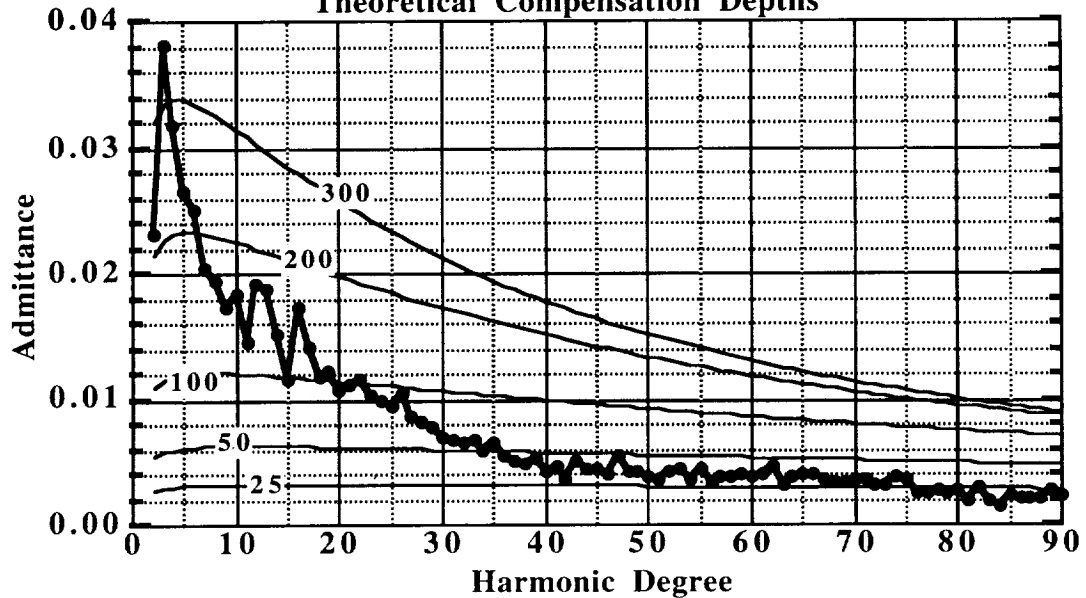




Figure 28: Correlation with Topography for N=61 to 90



**Figure 29: MGNP90LSAAP Admittance and Theoretical Compensation Depths**



about degree 30 are probably dominated by uncertainties in the topography, and for degree greater than 30, the errors are mostly from gravity. Since the errors neglect the correlations between degrees, the error bars are probably optimistic. The dip in correlation at degree 15 is real and the majority of it (80%) is due to the poor correlation between the zonal coefficients. The correlations for previous solutions are presented in Figure 24. Note the increase in correlation for the last ten degrees (65-75) for MGNP90LSAAP versus MGNP75ISAAP due to the removal of aliasing in these terms for the higher degree solution.

The correlation of gravity with topography can also be plotted spatially for different ranges of degree. Figures 25, 26, and 27 show the lower degree harmonic ranges of 2-10, 11-20, and 21-30. The correlations are calculated using a sliding window equal in size to the shortest wavelength. The lowest degree harmonics (Figure 25) show a substantial mismatch between gravity and topography over Eistla Regio. The drop in correlation is mainly due to the degree two through five harmonics. In the next harmonic range, Ishtar Terra, the "claw" of Aphrodite, Tellus Regio, and Thetis Regio appear. For the higher degree harmonics (>60), one can notice a general decrease in correlations for the areas where the data are weak (see Figure 10). Figure 28 shows the correlation averaged over a 30 degree window for terms between degrees 61 and 90 with the cross-hatched areas representing correlations below 0.4. This indicates that if we had global uniform tracking coverage, the correlations for the higher degrees in Figure 23 would be greater than 0.6.

Another measure of the geophysical processes that shape the gravity and topography is the admittance between them. The admittance function for each degree  $n$  is given by  $F_n = \gamma_n(G_n/T_n)$  or  $G_n \cdot T_n / T_n^2$  and is displayed in Figure 29 along with the theoretical curves for apparent depth of compensation for Airy compensation. The admittance at degree  $n$  is related to the depth  $D$  by (Turcotte and McAdoo, 1979)

$$F_n = \frac{3\rho_s}{(2n+1)\rho} \left[ 1 - \left(1 - \frac{D}{a_c}\right)^n \right] \quad (13)$$

where surface and mean densities are 2.9 and 5.248 gm/cm<sup>3</sup>, respectively. The admittance, like the correlations above, can be calculated spatially for different spectral windows. Simons et al (1994) have plotted the admittance on a global scale for several different spectral windows and inferred internal processes that match the admittance. Here, we calculate the admittance for the harmonic range 40 to 60. For this range, we expect the combined effect of dynamic or thermal support for the long wavelengths and the elastic support for the short wavelengths to be minimized. With the admittance we calculate the depth of compensation on a global scale. The result is displayed in Figure 30 with averages over a 30 degree window. Assuming Airy compensation for wavelengths of degree 40 to 60, the crustal thickness is 20 to 30 km for the Ishtar and western Aphrodite regions and thicker for areas such as Atla and Beta.

The Bouguer and isostatic anomalies are also used for geophysical interpretation and are given in Figures 31 and 32. The Bouguer acceleration is the difference between the vertical gravity acceleration at the surface and the theoretical vertical acceleration from uncompensated topography. In this case, the spherical harmonic topography coefficients  $A_{nm}$ ,  $B_{nm}$  are related to the theoretical gravity coefficients  $C_{nm}^t$ ,  $S_{nm}^t$  for use in the potential (equation 1) by

$$C_{nm}^t, S_{nm}^t = \frac{3\rho_s}{(2n+1)\rho} A_{nm}, B_{nm}$$

The large negative Bouguer anomalies for Aphrodite and Ishtar Terra are clearly evident in Figure 31. The isostatic anomaly evaluates the nonlinear difference between the gravity and topography. Given the gravity coefficients of degree  $n$  ( $G_n$ ) and the topography coefficients ( $T_n$ ), the isostatic coefficients are given by  $I_n = G_n - F_n T_n$  where  $F_n$  is the admittance. If the supporting mechanism (dynamic, isostasy) is linear, then the isostatic anomalies show the difference from the global average compensating mechanism. If for a positive anomaly, the isostatic anomaly is negative, then the feature has more compensation than the global average. If the gravity and isostatic anomalies are both positive, then there is less compensation. The small compensation of Maat Mons is clearly evident in Figure 32 as it is by far the largest isostatic anomaly. Figure 33 shows the isostatic anomaly for the Mead Crater. Since Mead is a negative gravity and isostatic anomaly, it is also much less compensated than the global average.

The stability of the solution for gravity and other parameters is given in part by the correlations in the covariance of estimated parameters. Appendix H lists the correlations between the nongravity parameters and the first degree and order five gravity coefficients. The solution in this case solves for the Venus pole and rotation. The correlations are generally fairly small with the largest correlation being 0.6. Figure 34 is a contour plot of the rms of the correlations between the coefficients of a given degree for the covariance of MGNP90LSAAP. With the a priori constraint, the correlations remain fairly small with the majority of rms values below 0.1. The correlations are a maximum for the lower harmonic

Figure 30: Apparent Depth of Compensation for  $N=41$  to 60

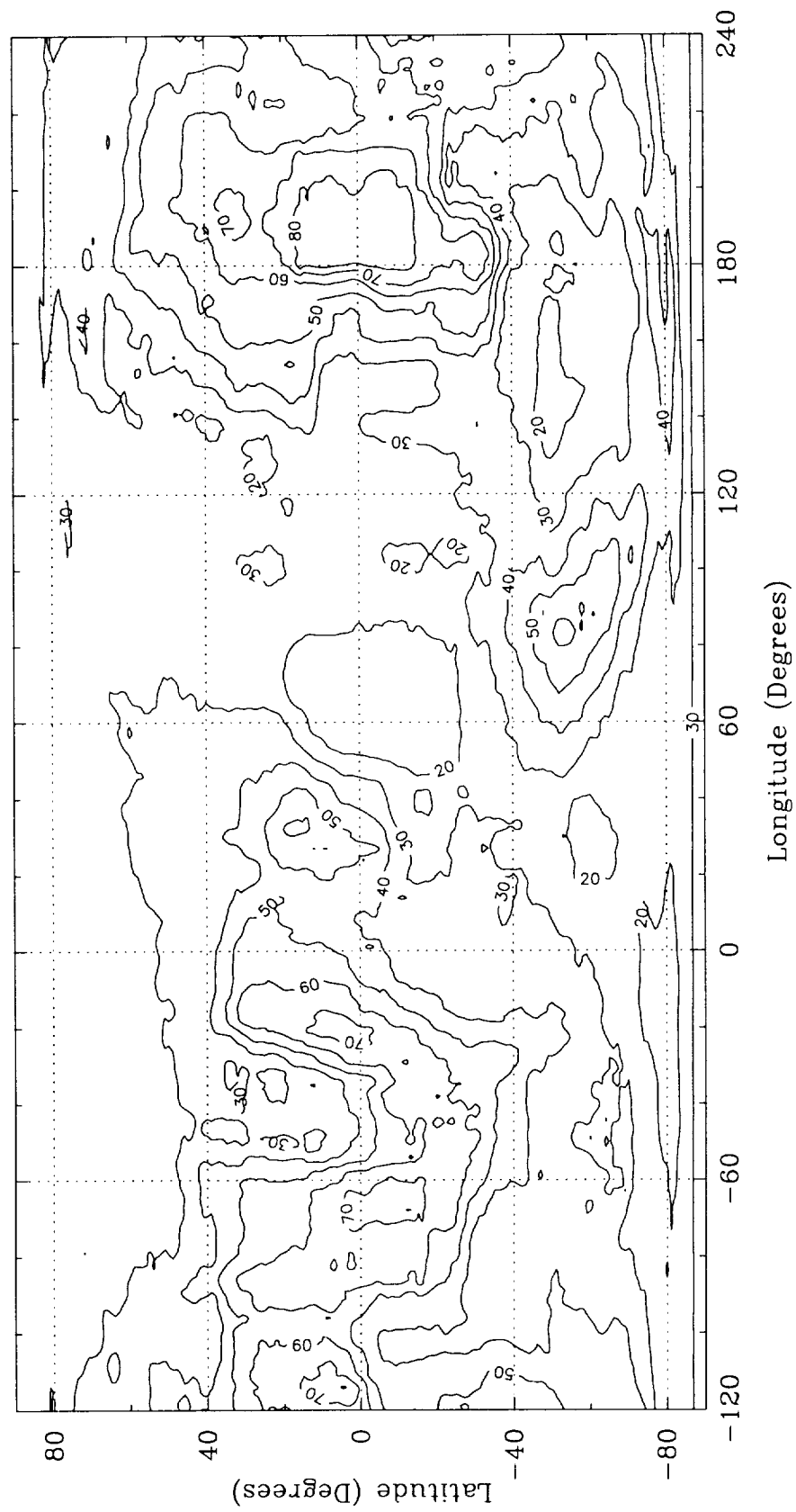


Figure 31: Bouguer Gravity for MGNP90LSAAP

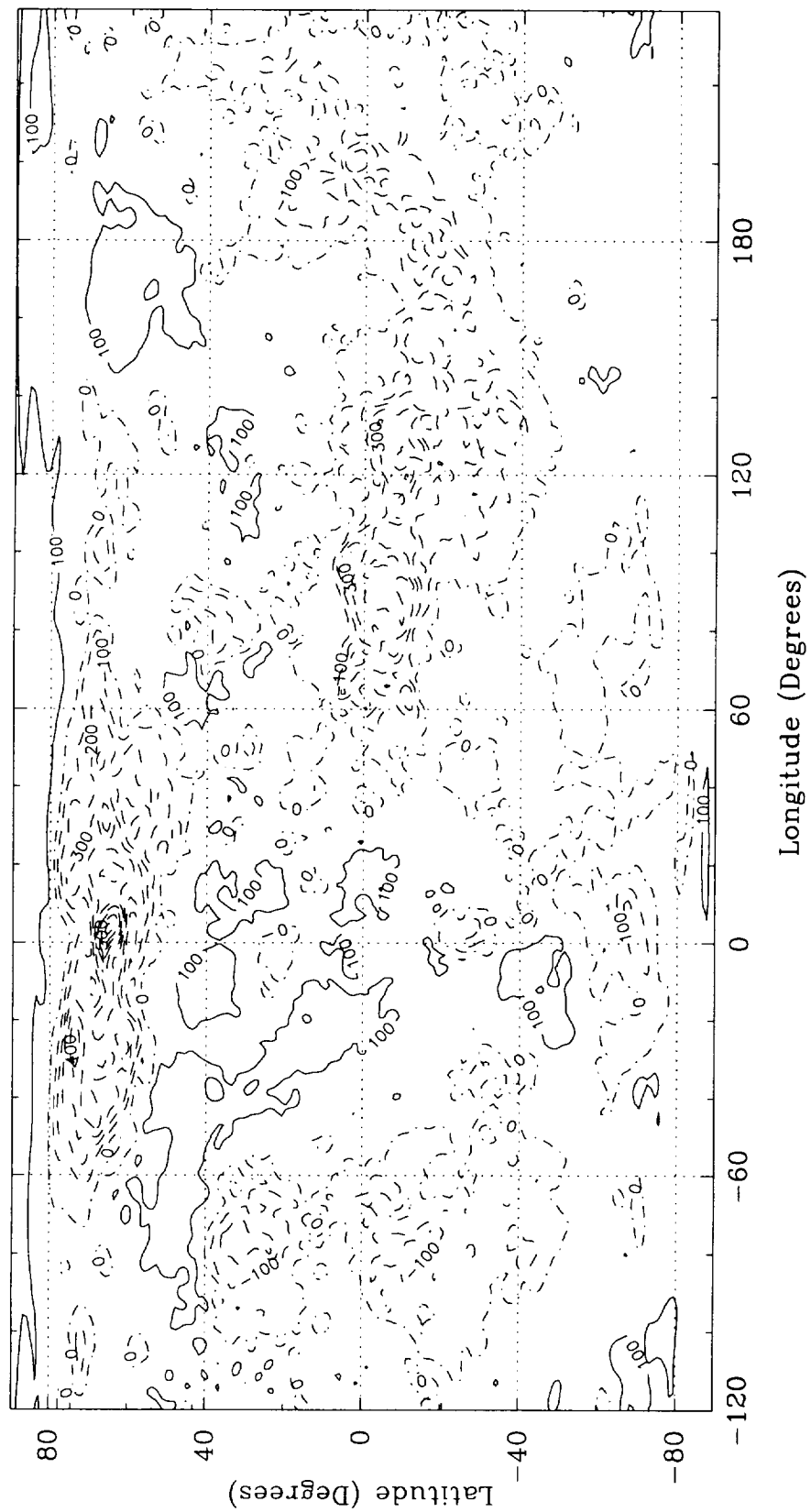


Figure 32: - Isostatic Perturbations for MGNP90LSAAP

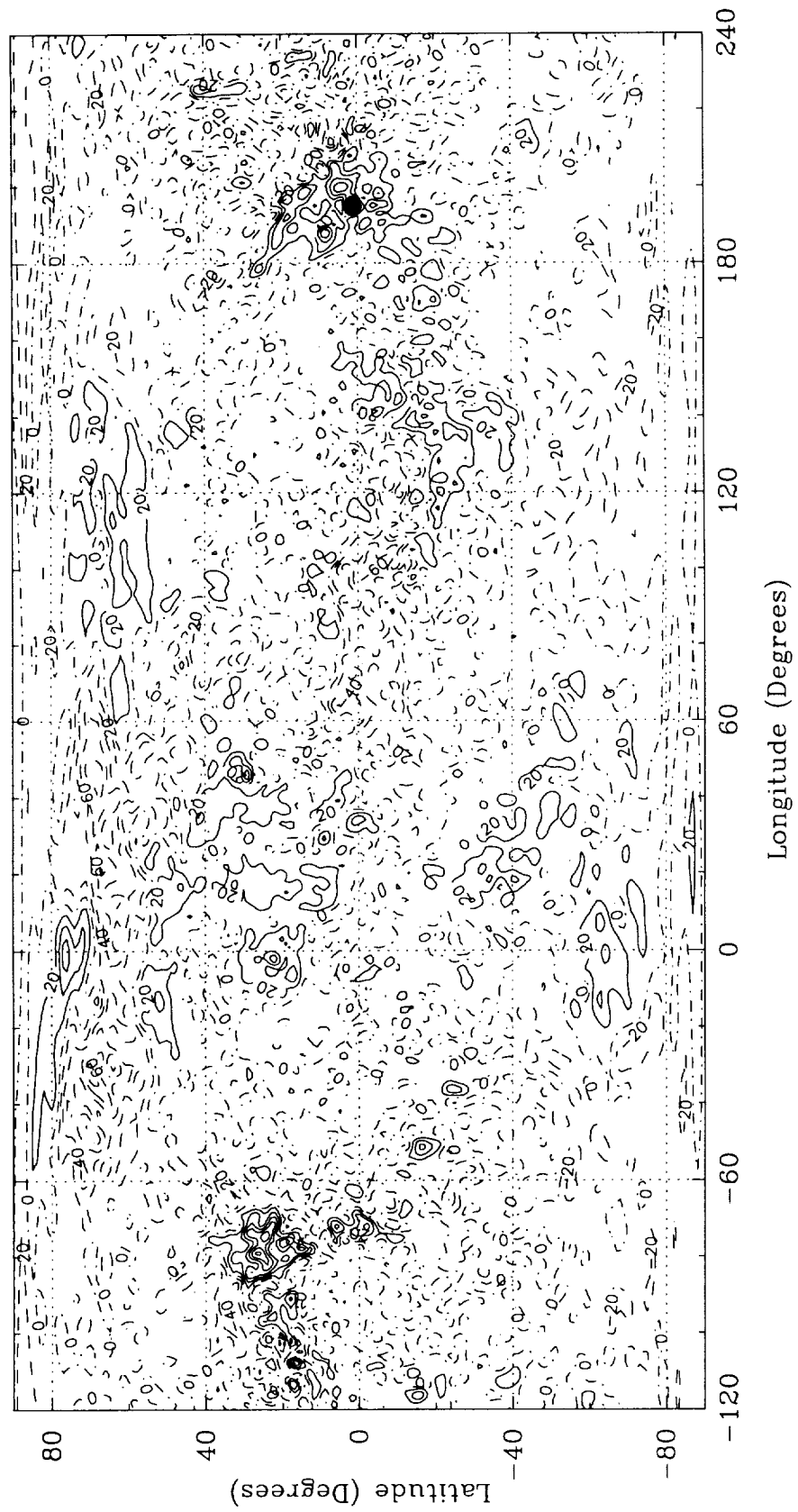


Figure 33: Isostatic Anomaly Map for Mead Crater

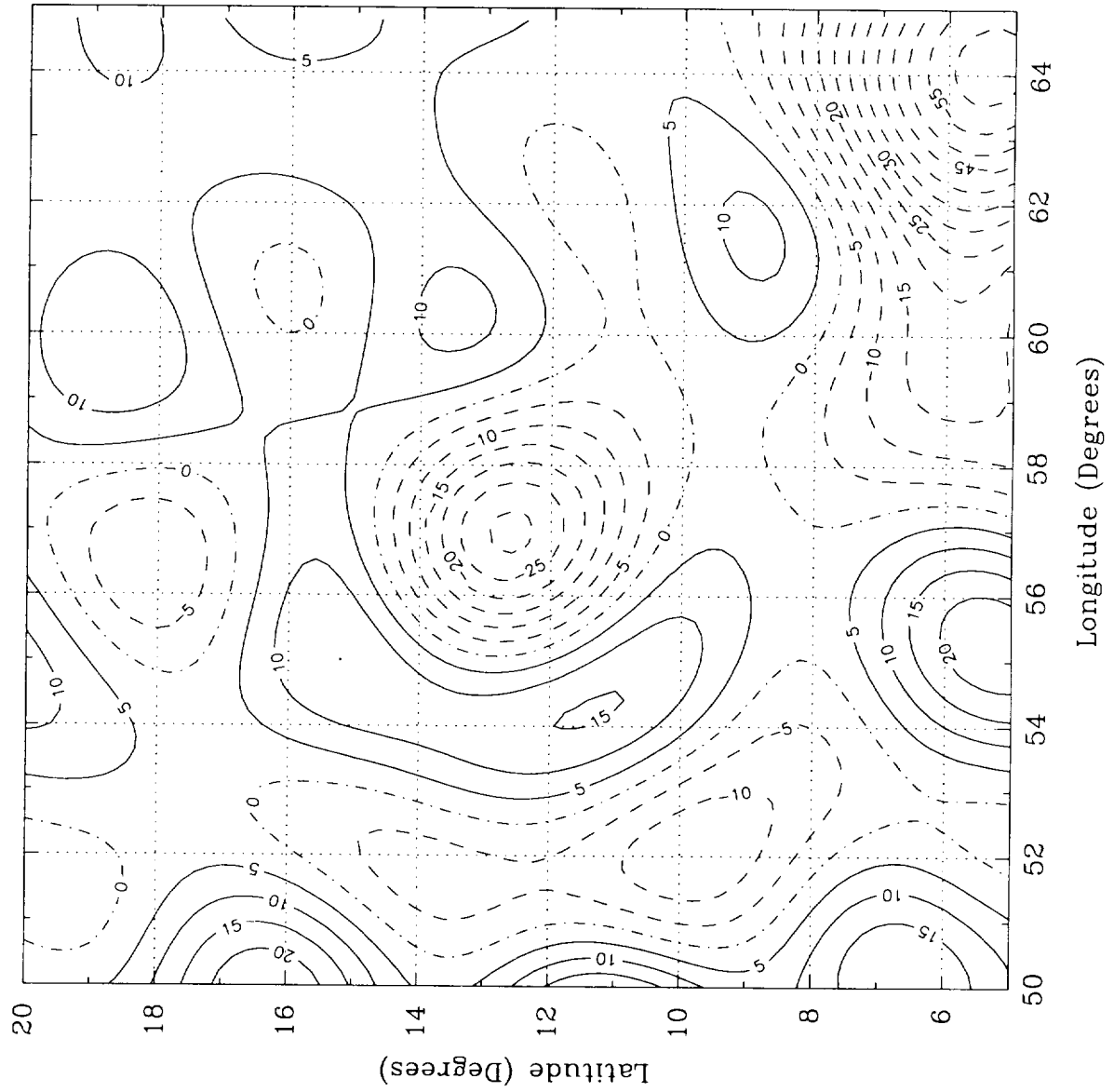
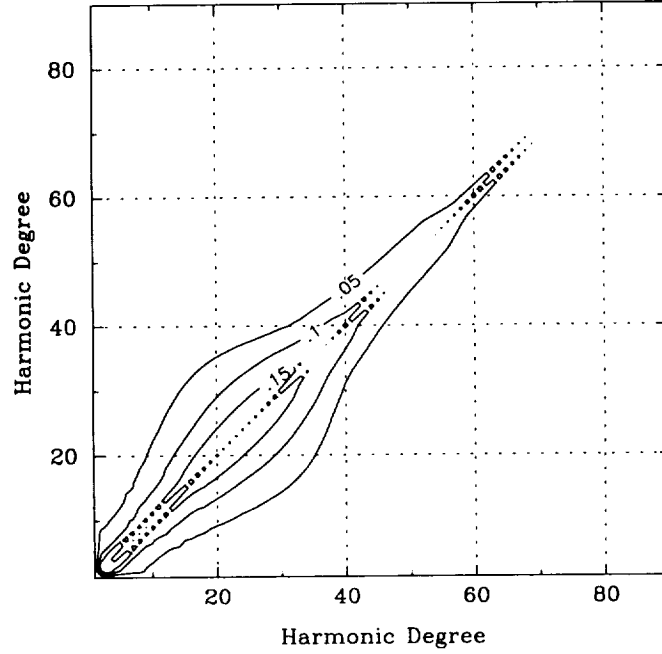


Figure 34: Gravity Coefficient Correlation Matrix



degrees and for degrees with the same approximate wavelength. We expect the correlations for the unconstrained covariance to be much greater for the higher degrees since the rms magnitude spectrum for the unconstrained spectrum is unrealistically large (Figure 22).

### 5b. Principal Axes

The principal axes of inertia are given by the second degree gravity harmonics. The unnormalized second degree coefficients are related to the moments and products of inertia about the body-fixed axes (1,2,3) by (Lambeck, 1988)

$$\begin{aligned}
 C_{20} &= \frac{-1}{M_v a_e^2} \left[ I_{33} - \frac{1}{2}(I_{11} + I_{22}) \right] \\
 C_{21} &= \frac{I_{13}}{M_v a_e^2} & S_{21} &= \frac{I_{23}}{M_v a_e^2} \\
 C_{22} &= \frac{1}{4M_v a_e^2} (I_{22} - I_{11}) & S_{22} &= \frac{I_{12}}{2M_v a_e^2}
 \end{aligned} \tag{14}$$

where  $M_v$  is the mass of Venus and  $a_e$  the reference radius. From equations (14), the inertia tensor with the moments of inertia along the diagonal and the negative products of inertia on the off diagonals is given by



Table 7. Principal Axes for Venus in Degrees

Axis	MGNP90LSAAP		MGNP75ISAAP		MGNP60FSAAP	
	Lat	Lon	Lat	Lon	Lat	Lon
1	0.38	-3.33	0.37	-3.20	0.19	-2.89
2	0.36	86.67	0.36	86.81	0.42	87.11
3	89.48	-139.87	89.48	-139.17	89.54	-117.27

$$\mathbf{I} = M_v a_g^2 \begin{bmatrix} (I_{33}/M_v a_g^2) + C_{20} - 2C_{22} & -2S_{22} & -C_{21} \\ -2S_{22} & (I_{33}/M_v a_g^2) + C_{20} + 2C_{22} & -S_{21} \\ -C_{21} & -S_{21} & I_{33}/M_v a_g^2 \end{bmatrix} \quad (15)$$

From the inertia matrix, the principal moments of inertia cannot be determined because only two relationships exist between the three moments of inertia. The third relationship comes from observing the rotational behavior of the body (i.e., the precession rate). However for Venus, there has been no observation of the precession. The principal axes, however, can be determined because the eigenvectors are independent of any constant added to the diagonal elements of the inertia tensor. By setting  $I_{33}=0$  in equation (15) and diagonalizing the matrix, the principal axes are determined and listed in Table 7.

Assuming a small offset  $\phi$  of the inertial axis from the spin or z-axis, the offset in terms of the unnormalized coefficients is given by

$$\phi^2 = \frac{C_{21}^2}{(C_{20} - 2C_{22})^2} + \frac{S_{21}^2}{(C_{20} + 2C_{22})^2} \quad (16)$$

The error in  $\phi$  is given by

$$\sigma_\phi^2 = \frac{\partial \phi^T}{\partial \mathbf{G}_2} \mathbf{P}_{\mathbf{G}_2} \frac{\partial \phi}{\partial \mathbf{G}_2}$$

where  $\mathbf{G}_2$  are the second degree coefficients and  $\mathbf{P}_{\mathbf{G}_2}$  is the covariance for the second degree coefficients. The partials are determined from equation (16). The formal sigma for the inertial offset from the spin axis is 0.01 degrees.

The pole offset to first order is given by the magnitude of the  $C_{21}$  and  $S_{21}$  gravity coefficients. Table 8 lists the normalized second degree coefficients and formal uncertainties for different data combinations. The variations are typically within three times the formal sigma except for the  $J_2$  solution with Magellan cycle 4, which deviates from the nominal solution by eight times the formal uncertainty. Since the Magellan data are processed with only one-day arcs, the stability of the lower degree harmonics may improve

Table 8. Normalized Second Degree Coefficients with Formal Uncertainties ( $\times 10^{10}$ ).

Data	Constraints	$\bar{J}_2$	$\bar{C}_{21}$	$\bar{S}_{21}$	$\bar{C}_{22}$	$\bar{S}_{22}$
P	40, K, lp	19776 $\pm$ 48	280 $\pm$ 48	-5 $\pm$ 55	8569 $\pm$ 79	-1114 $\pm$ 76
4	40, K, lp	19932 $\pm$ 24	320 $\pm$ 19	173 $\pm$ 12	8515 $\pm$ 44	-1142 $\pm$ 38
5	40, K, lp	19715 $\pm$ 30	357 $\pm$ 25	134 $\pm$ 13	8610 $\pm$ 24	-1016 $\pm$ 21
P+4	40, K, lp	19799 $\pm$ 16	289 $\pm$ 14	160 $\pm$ 9	8550 $\pm$ 26	-1124 $\pm$ 26
ALL	40, K, lp	19719 $\pm$ 6	290 $\pm$ 4	143 $\pm$ 4	8543 $\pm$ 9	-998 $\pm$ 8
P	90, K, lp	19778 $\pm$ 48	273 $\pm$ 48	-15 $\pm$ 56	8558 $\pm$ 81	-1104 $\pm$ 78
4	90, K, lp	19930 $\pm$ 26	362 $\pm$ 22	177 $\pm$ 12	8487 $\pm$ 46	-1091 $\pm$ 41
5	90, K, lp	19706 $\pm$ 35	316 $\pm$ 30	117 $\pm$ 14	8633 $\pm$ 25	-1046 $\pm$ 26
P+4	90, K, lp	19797 $\pm$ 17	296 $\pm$ 15	159 $\pm$ 10	8547 $\pm$ 26	-1113 $\pm$ 27
ALL	90, K, lp	19718 $\pm$ 7	291 $\pm$ 5	145 $\pm$ 5	8530 $\pm$ 10	-1001 $\pm$ 9
ALL	90, S, fp	19716 $\pm$ 7	290 $\pm$ 5	143 $\pm$ 5	8547 $\pm$ 9	-999 $\pm$ 9

Data: P=PVO, 4=Magellan cycle 4, 5=Magellan cycle 5

Constraints: 90, 40 = degree and order of solution, K = Kaula rule, S = Spatial (SAAP)

fp = fixed IAU pole, lp = loose pole (estimated pole and rotation rate for Venus)

with increased arc lengths - the intent of future studies. Independent of the length of the data arc, the formal uncertainties for the low degree harmonics are too low as a result of the noise characteristics of the Doppler (as discussed above, i.e., it is not white noise). Using a factor of three times the formal error, the pole offset with a realistic error is  $0.52 \pm 0.03$  degrees. Hence, these results give some confidence that there is a pole offset and that there is a wobble for Venus (Yoder and Ward, 1979).

### 5c. Love Number

The Love number is a time-varying part of the  $C_{22}$  and  $S_{22}$  coefficients as a function of the solar longitude. Since Venus rotates retrograde once every 243 days and orbits the Sun once every 221 days, the solar day on Venus is 117 Earth days. The highly eccentric PVO data include five coverages of all solar longitudes with respect to the body-fixed coordinates for the low-altitude periaipse orbit and three coverages of all solar longitudes for the high-altitude PVO orbit. In local-solar-time (i.e., the longitude of the spacecraft with respect to the tidal bulge), the coverage is about one-half of the solar longitude coverage. The eccentric (cycle 4) Magellan data have two full coverages of solar longitude and the post-aerobraking data have about five full coverages of solar longitude. So multiple periods of the tidal effect are sampled by all data sets.

Table 9 gives the Love number solution ( $k_2$ ) with the formal uncertainty for different data combinations as given by Konopliv and Yoder (1995c). From the 40th degree and order solution, the Love number estimate with a realistic error is  $k_2 = 0.295 \pm 0.066$  (2 x formal uncertainty). This value indicates a liquid core for Venus (Yoder, 1995), although a solid core cannot be absolutely ruled out. Yoder (1995) gives a range for a liquid core of 0.23-0.29 and a value near 0.17 if the iron core has solidified.

Table 9. Love Number Solutions.

Data	Constraints	$k_2$
P	40, K, lp	$0.230 \pm 0.244$
4	40, K, lp	$0.245 \pm 0.134$
5	40, K, lp	$0.301 \pm 0.062$
P+4	40, K, lp	$0.279 \pm 0.093$
ALL	40, K, lp	$0.295 \pm 0.033$
P	90, K, lp	$0.217 \pm 0.239$
4	90, K, lp	$0.309 \pm 0.138$
4	90, K, tp	$0.225 \pm 0.135$
5	90, K, lp	$0.337 \pm 0.070$
5	90, K, tp	$0.319 \pm 0.069$
ALL	90, K, lp	$0.320 \pm 0.035$
ALL	90, S, fp	$0.306 \pm 0.036$

Data: P=PVO, 4=Magellan cycle 4, 5=Magellan cycle 5 and 6

Constraints: 90, 40 = degree and order of solution, K = Kaula rule, S = Spatial (SAAP)

fp = fixed IAU pole, lp = loose pole (estimated pole and rotation rate for Venus)

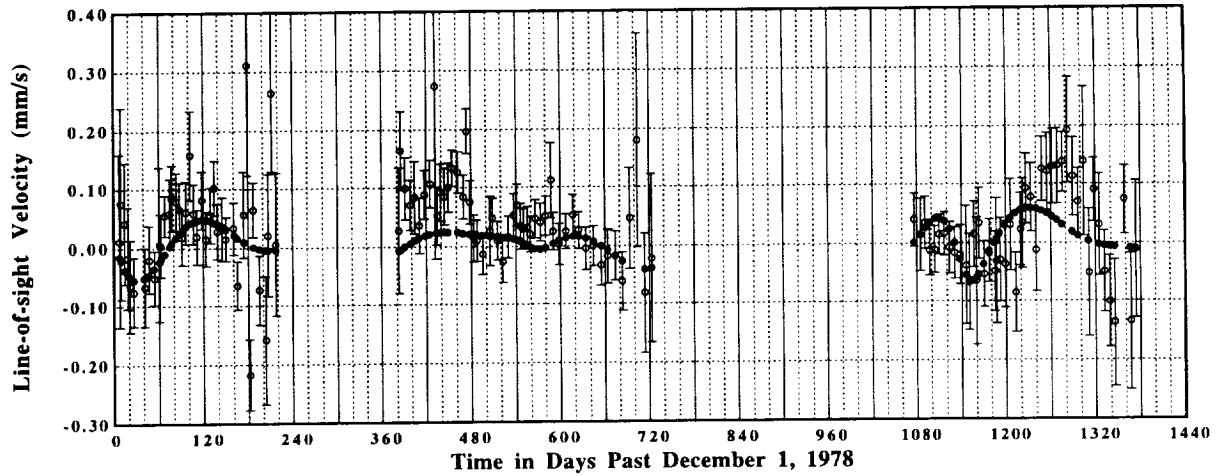
Future work will try to improve the Love number estimate by increasing the degree and order of the gravity field solution, increasing the length of the arcs, and improving the models of forces acting on the spacecraft. The ephemeris solution (discussed below) has shown sensitivity to the degree and order of the gravity solution and we expect the same sensitivity for the Love number. Appendix H shows that the Love number has fairly low correlations with the other global parameters with the maximum correlation being 0.31 with  $S_{44}$ . The Love number must be separated from the drag and albedo forces. The albedo force vanishes on the nightside of Venus and the drag force drops by an order of magnitude, which helps the determination of the tidal force.

## 6. Venus Constants

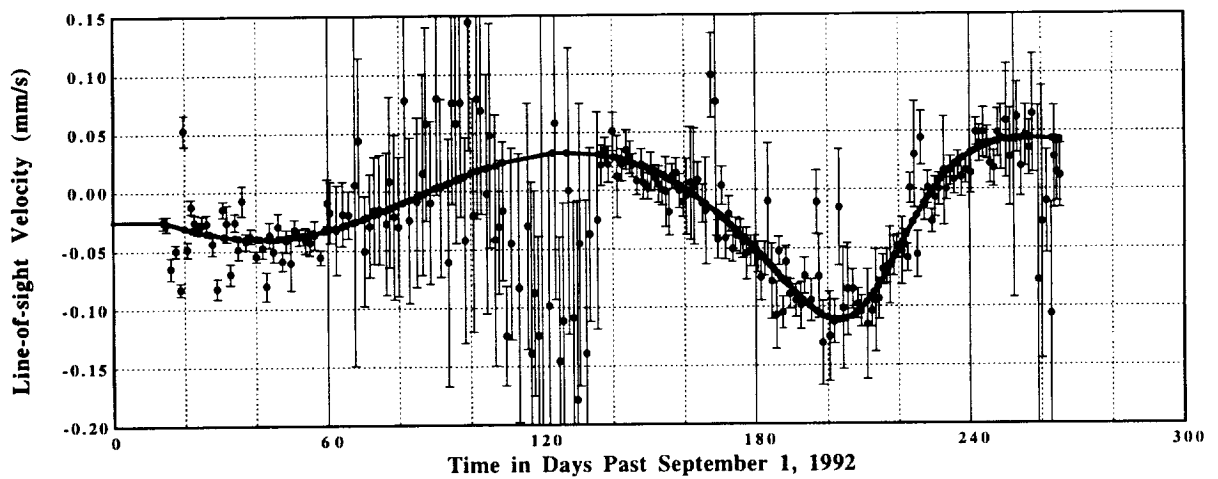
### 6a. Venus Ephemeris

The corrections to the Venus and Earth planetary ephemerides are estimated in the gravity solution using the Set III elements of Brouwer and Clemence (1961). The six elements for each planet are heliocentric and consist of changes in eccentricity ( $\Delta e$ ) and semi-major axis ( $\Delta a/a$ ) and corrections to the initial orientation of the orbit. The angle elements are  $\Delta l_0 + \Delta r$ ,  $\Delta p$ ,  $\Delta q$ , and  $e\Delta r$  where  $\Delta l_0$  is the change in mean anomaly at epoch,  $\Delta r$  is the rotation about the z-axis or ecliptic north, and  $\Delta p$  and  $\Delta q$  are the small rotations about the x and y axes (giving the inclination of the orbit). Table 10 lists the solutions for the corrections to the JPL ephemeris DE403 for different combinations of data. The a priori

**Figure 35: Ephemeris Solution for PVO wrt DE403**



**Figure 36: Ephemeris Solution for Magellan Cycle 4 wrt DE403**



**Figure 37: Ephemeris Solution for Magellan Cycle 5&6 wrt DE403**

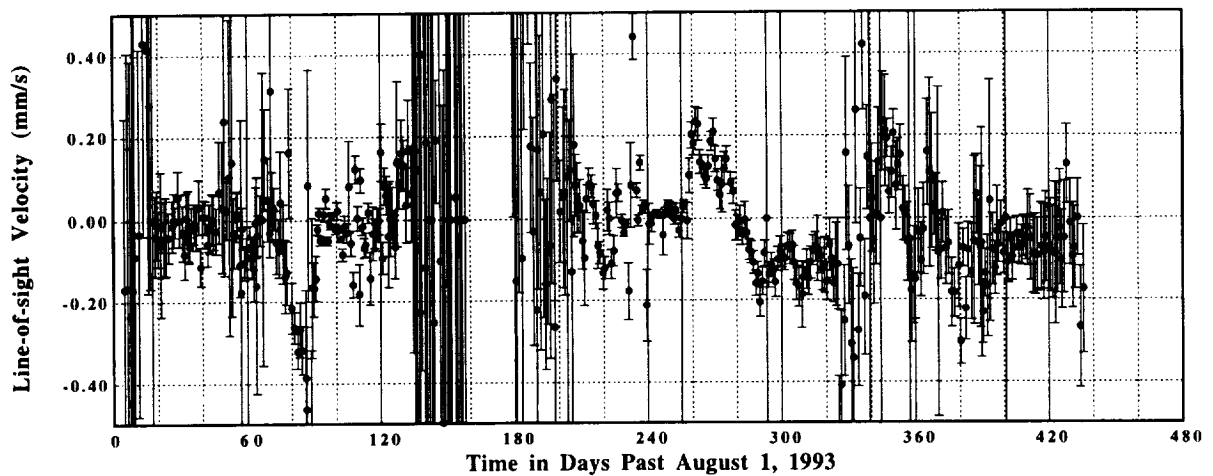


Table 10. Venus and Earth Ephemeris Solutions ( $\times 10^9$ ).

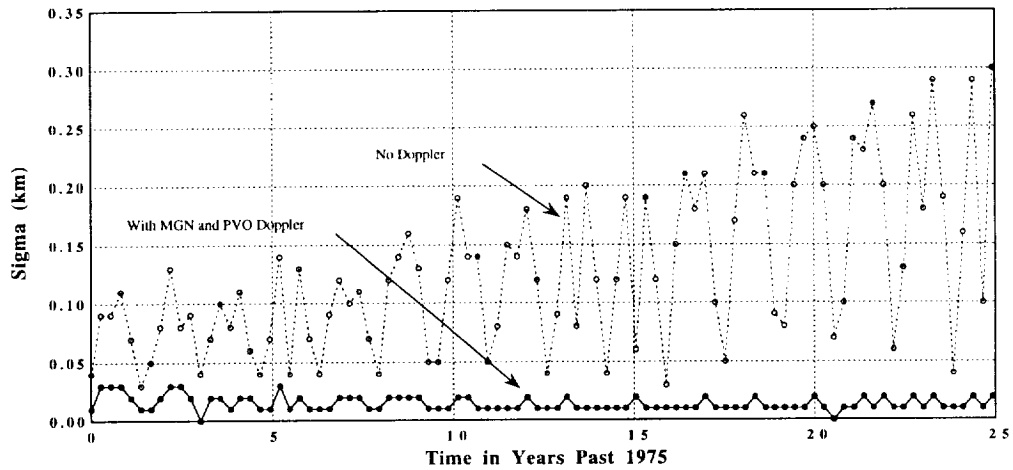
Element	PVO	MGN Cycle 4	MGN Cycle 5	MGNP90LSAAP
<i>Venus:</i>				
$\Delta lo + \Delta r$	$86.5 \pm 55.3$	$-13.5 \pm 97.4$	$-141.6 \pm 84.6$	$-80.9 \pm 13.9$
$e\Delta r$	$1.5 \pm 0.4$	$-1.9 \pm 1.2$	$1.3 \pm 1.4$	$0.9 \pm 0.2$
$\Delta a/a$	$0.6 \pm 0.3$	$-0.2 \pm 0.3$	$-0.5 \pm 0.2$	$-0.5 \pm 0.05$
$\Delta e$	$-0.2 \pm 0.3$	$1.1 \pm 1.3$	$-1.0 \pm 1.3$	$-0.8 \pm 0.2$
$\Delta p$	$27.4 \pm 44.1$	$-77.3 \pm 21.3$	$-17.3 \pm 28.5$	$-34.9 \pm 16.3$
$\Delta q$	$12.8 \pm 24.6$	$-78.2 \pm 40.2$	$-33.7 \pm 43.9$	$-14.6 \pm 16.4$
<i>Earth:</i>				
$\Delta lo + \Delta r$	$81.2 \pm 53.7$	$52.4 \pm 90.3$	$-7.8 \pm 97.0$	$-85.8 \pm 13.8$
$e\Delta r$	$1.0 \pm 0.5$	$0.9 \pm 0.9$	$2.8 \pm 1.2$	$0.9 \pm 0.2$
$\Delta a/a$	$1.0 \pm 0.5$	$0.0 \pm 0.4$	$-0.2 \pm 0.4$	$-0.8 \pm 0.1$
$\Delta e$	$0.8 \pm 0.4$	$2.7 \pm 1.2$	$-0.5 \pm 0.9$	$0.0 \pm 0.2$
$\Delta p$	$23.7 \pm 39.4$	$-18.6 \pm 25.2$	$-0.2 \pm 34.6$	$-20.2 \pm 15.4$
$\Delta q$	$24.8 \pm 31.2$	$-93.1 \pm 39.4$	$11.1 \pm 37.8$	$-30.8 \pm 17.2$

constraint on the ephemeris is zero with an uncertainty of  $10^{-6}$  for all the elements, and this is a minimal constraint.

The correlations of the Set III parameters are given in Appendix H and indicate that the absolute longitude and semi-major axes of the Earth and Venus are highly correlated (i.e., the Venus relative to Earth position is much better determined than absolute positions). The frame tie between the planetary reference frame and the International Earth Rotation Service (IERS) is known to about 40 nrad (Folkner et al, 1994a). The element  $\Delta r$  is a measure of this frame tie and the offset (80nrad) is greater than a realistic offset. This large value is due in part to the Magellan cycle 5 data (the value drops to 40 nrad without cycle 5 data) and the corrupting influence of higher order terms in the gravity field.

The Doppler data contain ephemeris information and this becomes more obvious when the relative velocity between the Earth and Venus (i.e., a Doppler bias) is estimated for each data arc (the MGNP90LSAAP gravity field is used and no global parameters are estimated). Figures 35, 36, and 37 show the solution for the Venus-to-Earth relative velocity with respect to DE403 for PVO, Magellan cycle 4, and Magellan cycle 5 and the formal uncertainties are given as error bars. The biases for the PVO data (Figure 35) are very sensitive to the ionospheric calibrations. The ionospheric calibrations for the high-altitude PVO data were not available for the generation of MGNP90LSAAP, but were for the solution of the Doppler biases. Plotted with the Doppler biases is the ephemeris solution. It was generated by Standish (private communication, JPL, 1995) using all the existing data for DE403 along with the Doppler biases for PVO and Magellan cycle 4 as observations (Magellan cycle 5 was not included due to systematic trends in the bias observations that are obviously not due to the ephemeris). The corrections to the initial state of Venus and Earth absorb the systematic trend in the Magellan cycle 4 data and some of the trends in the PVO data. The trend at 0.10 mm/s is determined to about 0.02 mm/s as given by the scatter in the bias solutions. The cycle 5 bias solutions contain trends that are

**Figure 38: Venus wrt Earth Radial Position Error**



most likely due to the higher than 90 degree field since the bias increases correspond to periaapse passage over the Atla Regio and apoapse passage over Beta Regio (after apoapse was lowered). Figure 38 displays the errors in the Venus relative to Earth ephemeris in the solution by Standish. The errors have been reduced from hundreds of meters to tens of meters. Increased arc lengths (3 days plus) should help in determination of the Doppler bias since this will help average out the signature of the Earth's rotation in the Doppler.

#### *6b. Venus Pole and Rotation*

The Venus spin pole and rotation rate are fixed to the IAU 1991 values for the formal delivery of the MGNP90LSAAP gravity solution. However, solutions of the pole and rotation rate are determined along with the gravity field and other global parameters. Table 11 lists the solutions for different data combinations. The pole location is given by the right ascension and declination of the pole in the Earth mean equator at epoch J2000 coordinate system. The IAU 1991 values are used as the a priori values with an uncertainty of 0.05 degree for the pole and 0.005 day for the rotation rate. For all but the final solution, the pole rate along with the position was estimated. The a priori on the pole rate is zero with an uncertainty of 0.05 deg/century (about the expected amplitude for the Venus precession rate, Yoder 1995). The pole rate is not well enough determined to give a precession rate but estimating it gives a marked increase in the formal statistic due to the almost 1.0 correlation between the pole position and rate in the covariance matrix.

Increasing the formal statistic by a factor of three, the pole solution is  $272.749 \pm 0.003$  degrees for the right ascension,  $67.160 \pm 0.003$  degrees for the declination, and  $243.0194 \pm 0.0006$  days for the rotation rate. Our rotation period solution is slightly longer than that determined by Davies et al (1992b) of  $243.0185 \pm 0.0001$ . Both, however are consistently below the 1988 IAU value (243.025) based upon Earth radar measurements of Venus and more recent radar determinations by Slade et al (1990) of

Table 11. Venus Pole and Rotation Rate Solutions

Data	Constraint	Right Ascension	Declination	Rotation Rate
P	90,K,rate	272.735±0.047	67.194±0.040	243.0192±0.0014
4	90,K,rate	272.779±0.027	67.115±0.012	243.0204±0.0019
5	90,K,rate	272.759±0.004	67.160±0.003	243.0189±0.0010
P+4	90,K,rate	272.789±0.015	67.162±0.008	243.0201±0.0004
ALL	90,K,rate	272.751±0.003	67.152±0.003	243.0192±0.00024
ALL	90,S,no rate	272.749±0.002	67.160±0.001	243.0194±0.00018

243.022 ± 0.003. The pole solution from Davies et al (1992b) is 272.76±0.02 for the right ascension and 67.16±0.01 for the declination and these solutions agree well within the error bars.

## 7. Solutions for Auxiliary Forces

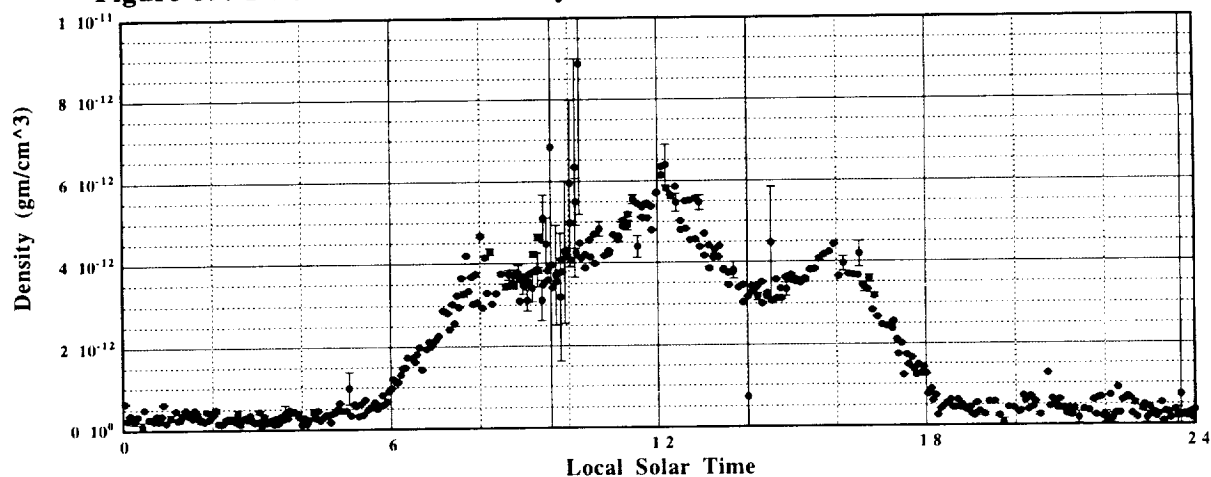
The auxiliary forces consist of solutions for the atmospheric drag, solar pressure, Venus albedo, Magellan momentum wheel desaturations, and Magellan hide information. The two most important forces (the drag and solar pressure) are addressed below. The solution trends for the other forces (mostly momentum wheel desaturations) have not been investigated in detail but will be checked for future models.

### 7a. Atmospheric Drag

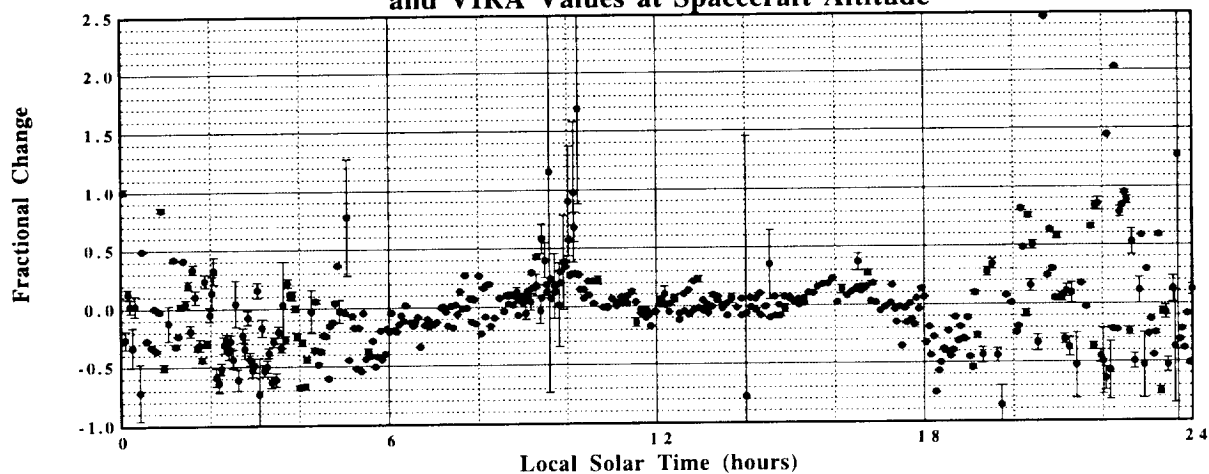
PVO with its high velocity through periapse (9km/s) and 24 hour period provides an excellent measure of the atmospheric density. Using the VIRa scale height profiles, the solutions for the PVO densities are mapped to a constant altitude of 140 km in Figure 39 with the error bars also given (the error bars are generally so small that they are not visible). The densities on the nightside of Venus are generally an order of magnitude smaller than the dayside. The PVO spacecraft passes through periapse from north to south with the antenna leading. The axis of symmetry for the cylinder has an angle-of-attack of 22 degrees at periapse. A drag coefficient of 2.2 is used and at the given angle of attack the cross-sectional area of the cylinder is 5.858 m<sup>2</sup>. The mass history was used for PVO and began at 362 kg and was 343 kg at the end of the low-altitude PVO coverage. These spacecraft values provide excellent agreement with the VIRa atmosphere model and this is not surprising since the VIRa model is, in part, based upon the PVO drag measurements (Keating et al, 1985). The differences with the VIRa model are displayed in Figure 40.

The solution for the lift-to-drag coefficient  $C_{L/D}$  (one per arc) versus LST is given in Figure 41. At this point, not much can be said about the magnitude of the lift except that the correct direction is being determined. For PVO, the expected values are 0.015 to 0.044 for an accommodation coefficient of 1.0 and 0.182 to 0.195 for 0.8 (D. Rault, private communication, Langley Research Center, Aerothermodynamics Branch, 1995). For now, the lift coefficient is constrained to zero with an uncertainty of 0.05. If the uncertainties are

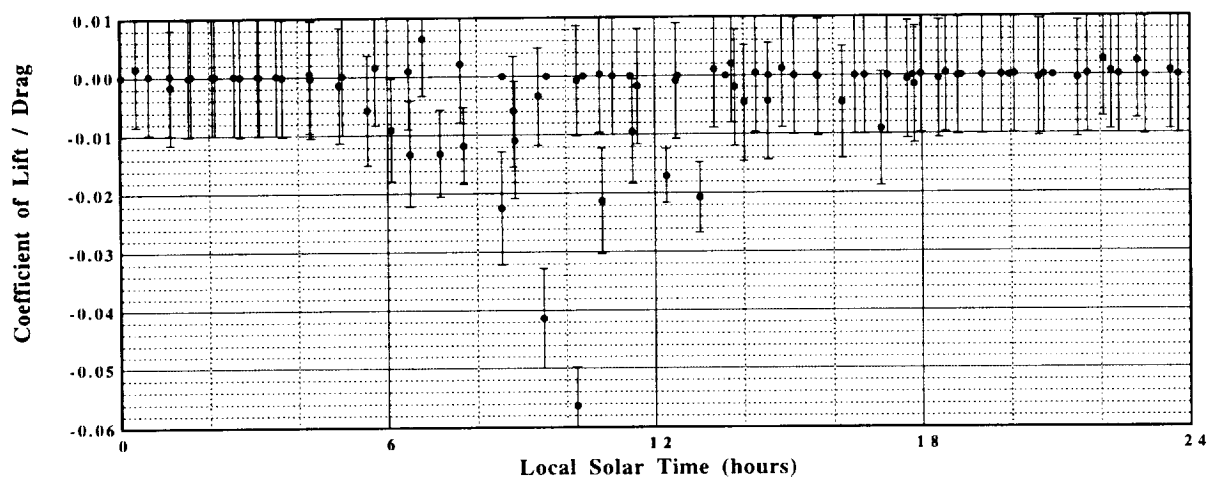
**Figure 39: PVO Low-Orbit Density Solution at 140 km Altitude**



**Figure 40: Difference of PVO Density Solutions and VIRA Values at Spacecraft Altitude**

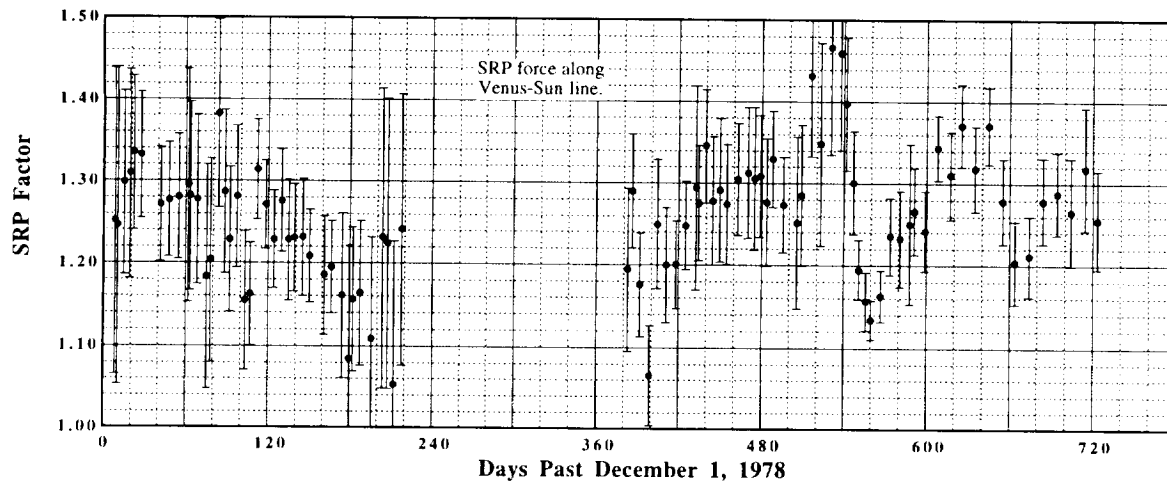


**Figure 41: PVO Low-Orbit Atmospheric Lift Solution**

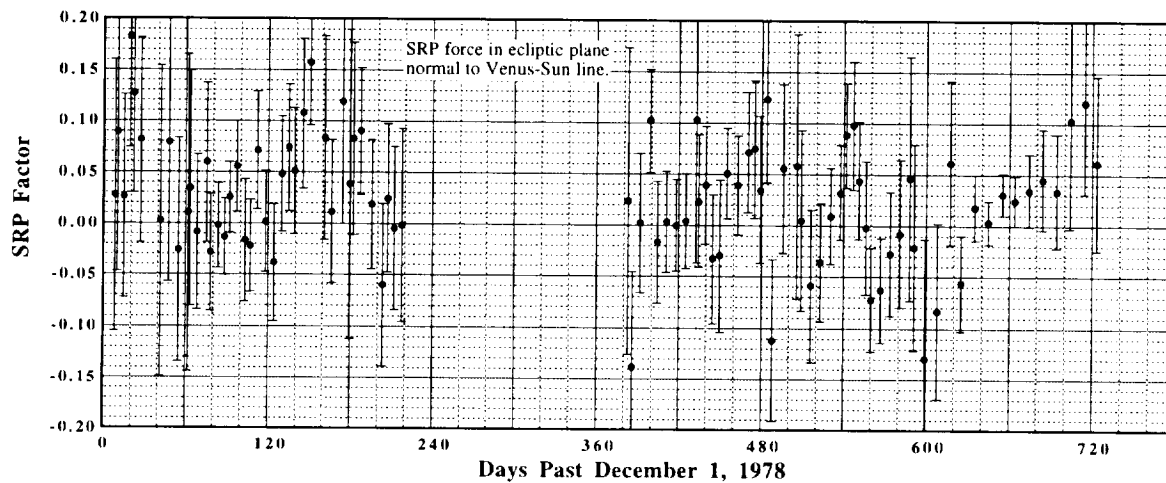




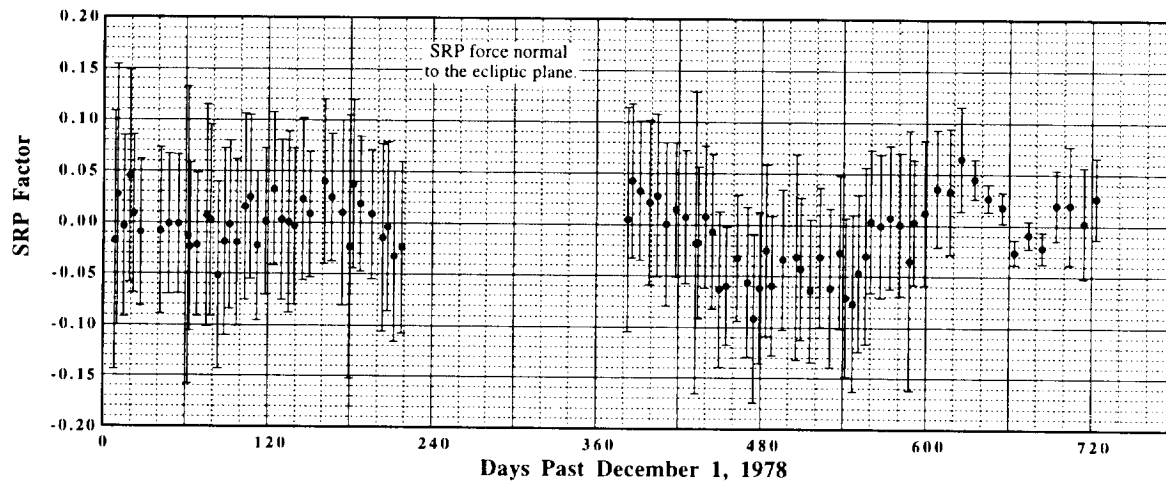
**Figure 42: PVO Low-Orbit Solar Radiation Pressure (GR) Solution**



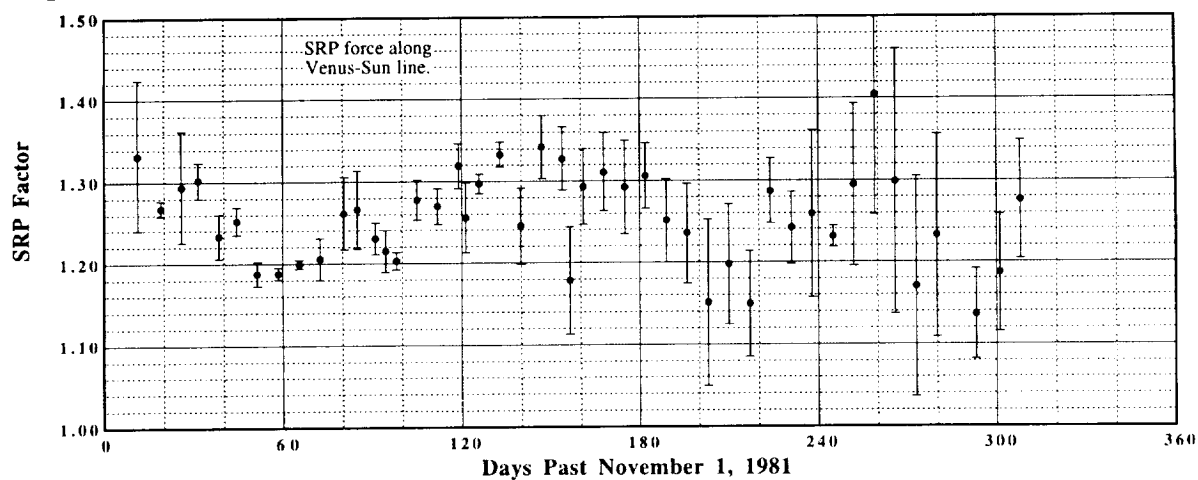
**Figure 43: PVO Low-Orbit Solar Radiation Pressure (GX) Solution**



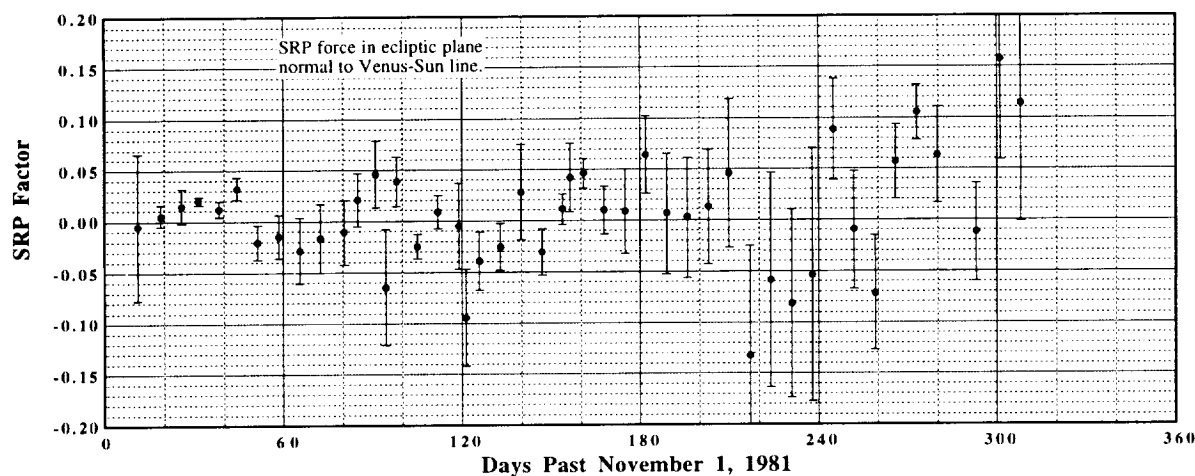
**Figure 44: PVO Low-Orbit Solar Radiation Pressure (GY) Solution**



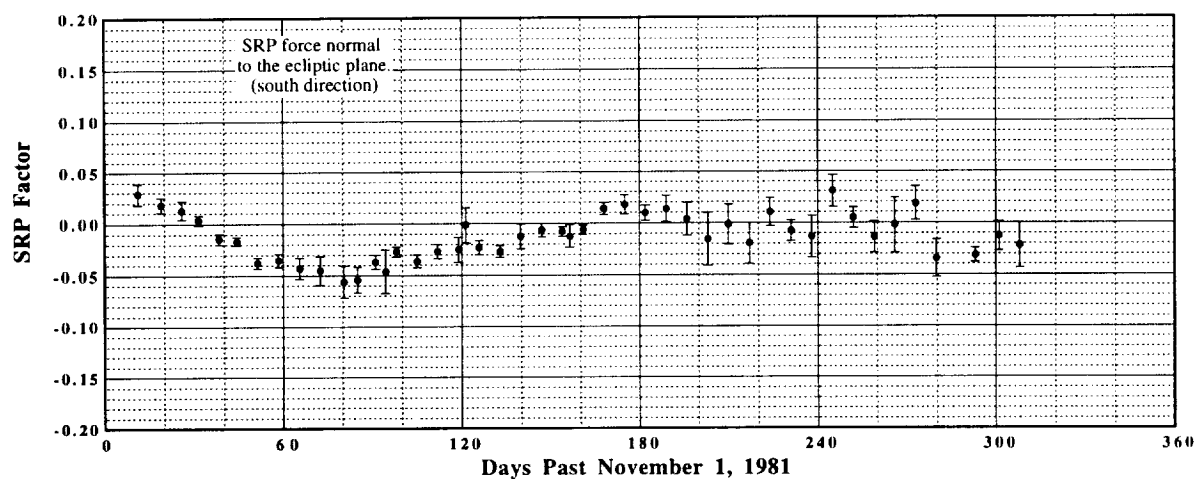
**Figure 45: PVO High-Orbit Solar Radiation Pressure (GR) Solution**



**Figure 46: PVO High-Orbit Solar Radiation Pressure (GX) Solution**



**Figure 47: PVO High-Orbit Solar Radiation Pressure (GY) Solution**



substantially relaxed then the values remain negative but fluctuate between -0.2 and -0.01. Also, they do not constrain the accommodation coefficient better than  $\pm 0.2$ . The  $C_{1/d}$  is only determined on the dayside where the density at the spacecraft is large. Future studies may investigate a sideslip (out of orbit plane) force that may be due to a moving atmosphere or a spacecraft orientation in the atmosphere.

The Magellan densities are not as well determined as those for PVO due to the higher altitude and shorter orbit period. The densities are constrained to  $1.0 \times 10^{-12}$  gm/cm<sup>3</sup> with 100% uncertainty. The resulting density solutions have uncertainties of about  $1 \times 10^{-12}$  gm/cm<sup>3</sup> with higher density values on the dayside and lower density values on the nightside. There is not nearly the density information for Magellan as there is for PVO. Future gravity models will constrain the density solutions closer to the VIRA values. The Magellan spacecraft passes through the atmosphere with the solar array axis along the velocity vector and so the drag is mainly from the spacecraft bus and high gain antenna. The antenna is at a right angle to the direction of flow. With the solar panels titled by 10 degrees into the direction of flow (80 degree angle of attack) the cross sectional area of the spacecraft is about 10 m<sup>2</sup>.

#### *7b. Solar Pressure*

The solar pressure solutions for the low-altitude and high-altitude PVO data are shown in Figures 42, 43, 44, 45, 46, and 47 for the three orthogonal solar pressure coefficients. The low-altitude uncertainties for the solar pressure are greater than the high-altitude due to the loss of information from the drag. The high-altitude solar pressure shows some systematic trends which are probably related to the modeling of solar pressure on the antenna as the antenna remains pointed to the Earth or to the albedo force from Venus. The albedo solution for the high-altitude PVO orbits (not shown) shows a systematic trend like the solar pressure and seems to be a function of the LST. It is probably related to varying reflectance properties of the Venusian clouds versus the incidence angles since the variations of 10% are greater than observed variations in the Venus albedo (which may be 1% at most). The albedo model assumes isotropic and diffuse reflectance from the Venus clouds. Taylor and Stowe (1984) have shown that for the Earth the reflectance is more specular for high incidence angles and the flux can vary by 10% to 20% depending on the zenith angle of the Sun and spacecraft and the relative azimuth. These systematic trends will be investigated in more detail in future analysis. The solar coefficients have an a priori uncertainty of 0.2 and are fairly well determined. The solar pressure solutions for the Magellan arcs are very poorly determined (the a priori uncertainty is not reduced) because of the increased number of atmospheric drag passages and the shorter data arcs.

Future efforts will attempt to improve the solar pressure model (maybe orientation, reflectivity coefficients) and increase the arc lengths - especially the high-altitude PVO orbits. With a better model and increased arcs, this should improve the information in the low degree harmonics and other global parameters such as the Love number.

## 8. Summary

With the gravity software now running on the massively parallel JPL Cray T3D Supercomputer, we have been able to increase the resolution of the Venus gravity field with dramatic improvements in the amount of time required to generate the solution (on the order of weeks for the supercomputer versus years with workstations). The Venus gravity model MGNP90LSAAP which is complete to degree and order 90 represents the best gravity solution to date. It shows increased correlation with topography over the last solution MGNP75ISAAP with minor improvements in the lower to medium degree harmonics and more improvement in the higher degree. Interpretation for smaller features (e.g., Mead Crater and Maat Mons) shows substantial improvement. The topography and this gravity model, which has been provided to the science community, provide the basis of geophysical interpretation.

Other parameters were estimated along with the gravity field. For the first time, we are sensing a Love number for another planet, perhaps indicating a liquid core. The Venus spin pole solution is most likely the best solution and the rotation rate of Venus is determined to a comparable level of the Magellan SAR data. The GM estimate for Venus is the best estimate to date and slightly better than previous determinations.

The models affecting the gravity solution have been reviewed. Many parameters and geometries that are useful in evaluating the Doppler data have been provided in the Appendices, hopefully making this a useful handbook.

## References

- Akim, E.L. Z.P. Vlasova, and I.V. Chuiko, "Determination of the Dynamical Flattening of Venus from Measurements of the Trajectories of Its First Artificial Satellites, Venera 9 and 10," *Sov. Phys. Dokl.*, 23, 313-315, 1978.
- Ananda, M.P., W.L. Sjogren, R.J. Phillips, R.N. Wimberly, and B.G. Bills, "A Low-Order Global Gravity Field of Venus and Dynamical Implications," *J. Geophys. Res.* 85, 8303-8318, 1980.
- Anderson, J.D., and L. Efron, "The Mass and Dynamical Oblateness of Venus," *Bull. Amer. Astron. Soc.* 1, 231, 1969.
- Banerdt, W.B., A.S. Konopliv, N.J. Rappaport, W.L. Sjogren, R.E. Grimm, and P.G. Ford, "The Isostatic State of Mead Crater," *Icarus* 112, 117-129, 1994.
- Barriot, J.P. and G. Balmino, "An Analysis of LOS Gravity Data Set from Cycle 4 of the Magellan Probe Around Venus", *Icarus* 112, 34-41, 1994.
- Battin, R.H., *An Introduction to the Mathematics and Methods of Astrodynamics*, AIAA Education Series, New York, 1987.
- Bent, R.B., S.K. Llewellyn, G. Nesterczuk, and P.E. Schmid, "The Development of a Highly Successful Worldwide Empirical Ionospheric Model," in J. Goodman (Ed.), *Effect of the Ionosphere on Space Systems and Communications*, Springfield, VA, National Technical Information Service, 13-28, 1976.
- Bierman, G. J., *Factorization Methods for Discrete Sequential Estimation*, Academic Press, New York, 1977.
- Bills, B.G., W.S. Kiefer, and R.L. Jones, "Venus Gravity: A Harmonic Analysis," *J. Geophys. Res.*, 92, 10335-10351, 1987.
- Boucher, C., Z. Altamimi, L. Duhem, "Results and Analysis of the ITRF93," IERS Technical Note 18, Central Bureau of IERS, Paris, France, October, 1994.
- Brouwer, D. and G. Clemence, *Methods of Celestial Mechanics*, Academic Press, New York, 241, 1961.
- Davies, M.E., V.K. Abalakin, A. Brahic, M. Bursa, B.H. Chovitz, J.H. Lieske, P.K. Seidelmann, A.T. Sinclair, and Y.S. Tjuflin, "Report of the IAU/IAG/COSPAR Working Group on Cartographic Coordinates and Rotational Elements of the Planets and Satellites: 1991," *Celes. Mech.* 53, 377-397, 1992a.
- Davies, M.E., T.R. Colvin, P.G. Rogers, P.W. Chodas, W.L. Sjogren, E.L. Akim, V.A. Stepanyantz, Z.P. Vlasova, and A.I. Zakharov, "The Rotation Period, Direction of the North Pole, and Geodetic Control Network of Venus," *J. Geophys. Res.*, 97, 13141-13151, 1992b.
- Ellis, J., "Large Scale State Estimation Algorithms for DSN Tracking Station Location Determination", *J. Astronaut. Sci.*, 28, 15-30, 1980.
- Esposito, P.B., W.L. Sjogren, N.A. Mottinger, B.G. Bills, and E. Abbott, "Venus Gravity: Analysis of Beta Regio," *Icarus* 51, 448-459, 1982.
- Estefan, J.A. and O.J. Sovers, "A Comparative Survey of Current and Proposed Tropospheric Refraction-Delay Models for DSN Radio Metric Data Calibration," JPL Publication 94-24, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, October, 1994.

- Folkner, W.M., "Station Location Covariance for Mars Observer," JPL IOM 335.1-92-004 (internal document), Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, January 27, 1992a.
- Folkner, W.M., "DE234 Station Locations and Covariance for Mars Observer," JPL IOM 335.1-92-013 (internal document), Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, May 26, 1992b.
- Folkner, W.M., P. Charlot, M.H. Finger, J.G. Williams, O.J. Sovers, XX Newhall, and E.M. Standish, "Determination of the Extragalactic-Planetary Frame Tie from Joint Analysis of Radio Interferometric and Lunar Laser Ranging Measurements," *Astron. Astrophys.* 287, 279-289, 1994a.
- Folkner, W.M., "Effect of Uncalibrated Charged Particles on Doppler Tracking," JPL IOM 335.1-94-005 (internal document), Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, March 1, 1994b.
- Goltz, G.L., "DSN Tracking System Interfaces: Orbit Data File Interface Mark IVA," TRK-2-18 of DSN Document 820-13, Rev. A (internal document), Jet Propulsion Laboratory, Pasadena, CA, 1988a (currently under revision).
- Goltz, G.L., "DSN Tracking System Interfaces: Archival Tracking Data File Interface," TRK-2-25 of DSN Document 820-13, Rev. A (internal document), Jet Propulsion Laboratory, Pasadena, CA, 1988b.
- Gross, R.S., "A Combination of Earth Orientation Data: Space91," In *IERS Technical Note 11, Earth orientation reference frames and atmospheric excitation functions submitted for the 1991 IERS Annual Report* (P. Charlot, Ed.), Central Bureau of IERS, Paris, France, 1992.
- Heiskanen, W.A. and H. Moritz, *Physical Geodesy*, W.H. Freeman, San Francisco, 1967.
- Howard, H.T., G.L. Tyler, G. Fjeldbo, A.J. Kliore, G.S. Levy, D.L. Brunn, R. Dickinson, R.E. Edelson, W.L. Martin, R.B. Postal, B. Seidel, T.T. Sesplaukis, D.L. Shirley, C.T. Stelzried, D.N. Sweetnaum, A.I. Zygielbaum, P.B. Esposito, J.D. Anderson, I.I. Shapiro, and R.D. Reasenberg, "Venus: Mass, Gravity Field, Atmosphere and Ionosphere as Measured by Mariner 10 Dual Frequency Radio System," *Science* 183, 1297-1301, 1974.
- International Earth Rotation Service (IERS), 1994 IERS Annual Report, Central Bureau of IERS, Paris, France, July, 1995.
- Kaula, W.M., *Theory of Satellite Geodesy*, Blaisdell, Waltham, MA, 1966.
- Kaula, W.M., "Regional Gravity Fields on Venus from Tracking of Magellan Cycles 5 and 6," *J. Geophys. Res. Planets*, in press, 1995.
- Keating, G.M., J.L. Bertaux, S.W. Bougher, T.E. Cravens, R.E. Dickinson, A.E. Hedin, V.A. Krasnopolsky, A.F. Nagy, J.Y. Nicholson III, L.J. Paxton, U. von Zahn, "Models of Venus Neutral Upper Atmosphere: Structure and Composition," *Adv. Space Res.* 5, 117-171, 1985.
- Knocke, P. and J. Ries, "Earth Radiation Pressure Effects on Satellites," Center for Space Research Technical Memorandum, University of Texas at Austin, Sept. 1987.
- Konopliv, A.S., B.G. Williams, E.J. Christensen, "A Venus Gravity Solution to Degree and Order 42 from PVO Data Only," presented at *AGU Spring Meeting*, Montreal, Canada, 1992.

- Konopliv, A. S., N. J. Borderies, P. W. Chodas, E. J. Christensen, W. L. Sjogren, B. G. Williams, G. Balmino, and J. P. Barriot, "Venus Gravity and Topography: 60th Degree and Order Model", *Geophys. Res. Lett.* 20, No. 21, pp. 2403-2406, 1993a.
- Konopliv, A. S., W. L. Sjogren, R. N. Wimberly, R. A. Cook, A. Vijayaraghavan, "A High Resolution Lunar Gravity Field and Predicted Orbit Behavior," AAS Paper 93-622 in *Proceedings of the AAS/AIAA Astrodynamics Specialist Conference held August 16-19, 1993, Victoria, British Columbia, Canada*, Univelt, San Diego, 1275-1294, 1993b.
- Konopliv, A. S., and W. L. Sjogren, "Venus Spherical Harmonic Gravity Model to Degree and Order 60", *Icarus* 112, 42-54, 1994a.
- Konopliv, A. S., W. L. Sjogren, E. Graat, J. Arkani-Hamed, "Venus Gravity Data Reduction", Presentation at Fall 1994 Meeting, American Geophysical Union, San Francisco, CA, December 5-9, 1994b.
- Konopliv, A.S. and W.L. Sjogren, "The JPL Mars Gravity Field, Mars50c, Based Upon Viking and Mariner 9 Doppler Tracking Data," JPL Publication 95-5, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, February, 1995a.
- Konopliv, A.S., "DDF Final Report," JPL IOM 312.D-95-103 (internal document), Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, Oct. 5, 1995b.
- Konopliv, A.S., and C.F. Yoder, "Venusian  $k_2$  Tidal Love Number from Magellan and PVO Tracking Data," submitted to *Geophys. Res. Lett.*, 1995c.
- Lambeck, K., *Geophysical Geodesy: The Slow Deformation of the Earth*, Clarendon Press, Oxford, 1988.
- Lawson, C. L. and R. J. Hanson, *Solving Least Squares Problems*, SIAM Classics in Applied Mathematics, Vol. 15, Society for Industrial and Applied Mathematics, Philadelphia, 1995.
- Lemoine, F.G., "Mars: The Dynamics of Orbiting Satellites and Gravity Model Development," Ph.D. thesis, Univ. of Colorado, Boulder, 1992.
- Lemoine, F.G., D.E. Smith, M.T. Zuber, and G.A. Neumann, "High Degree and Order Spherical Harmonic Models for the Moon and Historic S-Band Doppler Data," IUGG, XXI General Assembly, Boulder, CO, 1995.
- Lieske, J.H., T. Lederle, W. Fricke, B. Morando, "Expression for the Precession Quantities Based upon the IAU (1976) System of Astronomical Constants," *Astron. Astrophys.* 58, 1-16, 1977.
- McCarthy, D.D., et al, IERS Technical Note 3, Central Bureau of IERS, Paris, France, November 1989.
- McKenzie, D. and F. Nimmo, "Elastic Thickness Estimates for Venus from Line-of-Sight Accelerations," *Icarus*, in press, 1995.
- McNamee, J.B., G.R. Kronschnabl, S.K. Wong, and J.E. Ekelund, "A Gravity Field to Support Magellan Navigation and Science at Venus," *J. Astron. Sci.*, 40, 107-134, 1992.
- McNamee, J.B., N.J. Borderies and W.L. Sjogren, "Venus: Global Gravity and Topography," *J. Geophys. Res. Planets*, 98, E5, 9113-9128, 1993.

- Mottinger, N.A., W.L. Sjogren and B.G. Bills, "Venus Gravity: A Harmonic Analysis and Geophysical Implications," *J. Geophys. Res.* 90, 739-756, 1985.
- Moyer, T. D., Mathematical Formulation of the Double-Precision Orbit Determination Program (DPODP). JPL Technical Report 32-1527. Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, 1971.
- Moyer, T.D., "Changes for Voyager Jupiter Encounter / Pioneer Venus Orbiter Version of Regres," JPL IOM 314.7-122 (internal document), Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, November 7, 1977.
- Moyer, T.D., "Transformation from Proper Time on Earth to Coordinate Time in Solar System Barycentric Space-Time Frame of Reference, Parts 1 and 2," *Celes. Mech.* 23, 33-68, 1981.
- Moyer, T.D., "Station Location Sets LS111B and LS118," JPL IOM 314.5-724 (internal document), Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, October 26, 1983.
- Moyer, T.D., "Changes to the ODP and the ODE for Processing X-Band Uplink Data," JPL EM 314-430 (internal document), Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, October 15, 1987.
- Moyer, T.D., "Station Location Sets Referred to the Radio Frame," JPL IOM 314.5-1334 (internal document), Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, February 24, 1989.
- Moyer, T.D., "Relativistic Equations of Motion for Earth Satellites in Geocentric and Solar System Barycentric Frames of Reference," JPL EM 314-476 (internal document), Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, January 15, 1990.
- Nerem, R.S., "An Improved Gravity Model for Venus Using Tracking Data from Pioneer Venus Orbiter," *Eos Trans. AGU*, 72(17), 174-175, 1991.
- Nerem, R.S., B.G. Bills and J.B. McNamee, "A High Resolution Gravity Model for Venus: GVM-1," *Geophys. Res. Lett.*, 20, 7, 599-602, 1993.
- Nerem, R.S., F.J. Lerch, J.A. Marshall, E.C. Pavlis, B.H. Putney, J.C. Chan, S.M. Klosko, S.B. Luthcke, G.B. Patel, N.K. Pavlis, R.G. Williamson, B.D. Tapley, R.J. Eanes, J.C. Ries, B.E. Schutz, C.K. Shum, M.M. Watkins, R.H. Rapp, R. Biancale, and F. Nouel, "Gravity Model Development for TOPEX/Poseidon: Joint Gravity Models 1 and 2," *J. Geophys. Res.*, 99, 24421-24447, 1994.
- Nerem, R.S., C. Jekeli, W.M. Kaula, "Gravity Field Determination and Characteristics: Retrospective and Prospective," *J. Geophys. Res.*, 100, 15053-15074, 1995.
- Phillips, R.J., W.L. Sjogren, E.A. Abbott, J.C. Smith, R.N. Wimberly, and C.A. Wagner, "Gravity field of Venus: A preliminary analysis," *Science*, 205, 93-96, 1979.
- Rapp, R.H., Y.M. Wang, and N.K. Pavlis, "The Ohio State 1991 Geopotential and Sea Surface Topography Harmonic Coefficient Models," Rep. 410, Dep. of Geod. Sci. and Surv., Ohio State Univ., Columbus, Aug. 1991.
- Rappaport, N. J., and J. J. Plaut, "A 360-Degree and -Order Model of Venus Topography," *Icarus* 112, 27-33, 1994.
- Reasenber, R.D., Z.M. Goldberg, P.E. MacNeil, and I.I. Shapiro, "Venus Gravity: A High Resolution Map," *J. Geophys. Res.*, 86, 7173-7179, 1981.



- Reasenberg, R.D., Z.M. Goldberg, and I.I. Shapiro, "Venus: Comparison of Gravity and Topography in the Vicinity of Beta Regio," *Geophys. Res. Lett.*, 9, 637-640, 1982.
- Reasenberg, R.D. and Z.M. Goldberg, "High-Resolution Gravity Model of Venus," *J. Geophys. Res.*, 97, E9, 14681-14690, 1992.
- Seidelmann, P.K. "1980 IAU Nutation: The Final Report of the IAU Working Group on Nutation," *Celest. Mech.* 27, 79-106, 1982.
- Simons, M., B.H. Hager, and S.C. Solomon, "Global Variations in the Geoid/Topography Admittance of Venus," *Science*, 264, 798-803, 1994.
- Simpson, R.A, "Magellan Spherical Harmonic ASCII Data Record (SHADR)," Magellan Software Interface Specification MGN-SHADR, Ver. 1.0, Washington University PDS Geosciences Node, St. Louis, MO, 1993a.
- Simpson, R.A, "Magellan Spherical Harmonic Binary Data Record (SHBDR)," Magellan Software Interface Specification MGN-SHBDR, Ver. 1.0, Washington University PDS Geosciences Node, St. Louis, MO, 1993b.
- Simpson, R.A, "Line-of-Sight Acceleration Profile Data Record (LOSAPDR)," Magellan Software Interface Specification NAV-138, Ver. 1.13.1, Washington University PDS Geosciences Node, St. Louis, MO, 1995a.
- Simpson, R.A, "Radio Science Digital Map (RSDMAP)," Magellan Software Interface Specification SU-MGN-RSDMAP, Ver. 1.0.2, Washington University PDS Geosciences Node, St. Louis, MO, 1995b.
- Sjogren, W.L., R.J. Phillips, P.W. Birkeland, and R.N. Wimberly, "Gravity Anomalies on Venus," *J. Geophys. Res.*, 85, 8295-8302, 1980.
- Sjogren, W.L., B.G. Bills, P.W. Birkeland, P.B. Esposito, A.S. Konopliv, N.A. Mottinger, R.J. Phillips, and S.J. Ritke, "Venus Gravity Anomalies and Their Correlation With Topography," *J. Geophys. Res.*, 88, 1119-1128, 1983.
- Sjogren, W.L., B.G. Bills and N.A. Mottinger, "Venus: Ishtar Gravity Anomaly," *Geophys. Res. Lett.*, 11, No. 5, 489-491, 1984.
- Sjogren, W.L., G.B. Trager, and G.R. Roldan, "Venus: A Total Mass Estimate," *Geophys. Res. Lett.*, 17, 1485-1488, 1990.
- Slade, M.A., S. Zohar, and R.F. Jurgens, "Venus: Improved Spin Vector from Goldstone Radar Observations," *Astron. J.*, 100, 1369-1374, 1990.
- Smith, D.E., F.J. Lerch, R.S. Nerem, M.T. Zuber, G.B. Patel, S.K. Fricke, and F.G. Lemoine, "An Improved Gravity Model for Mars: Goddard Mars Model 1," *J. Geophys. Res.*, 98, 20871-20889, 1993.
- Smrekar, S.E., "Evidence for Active Hotspots on Venus from Analysis of Magellan Gravity Data", *Icarus* 112, 1994.
- Standish, E.M., XX Newhall, J.G. Williams, and W.M. Folkner, "JPL Planetary and Lunar Ephemerides, DE403/LE403," JPL IOM 314.10-127 (internal document), Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, May 22, 1995.
- Standish, E.M., "The Observational Basis for JPL's DE 200, the Planetary Ephemerides of the Astronomical Almanac," *Astron. Astrophys.* 233, 252-271, 1990.
- Steppe, J.A., S.H. Oliveau, and O.J. Sovers, "Earth Rotation Parameters from DSN VLBI: 1991," Earth orientation and reference frame determinations, atmospheric

- excitation functions, up to 1990, IERS Technical Note 8, Central Bureau of IERS, Paris, France, 47-60, October, 1991.
- Taylor, F.W., D.M. Hunten, L.V. Ksanfomaliti, "The Thermal Balance of the Middle and Upper Atmosphere of Venus," *Venus*, D.M. Hunten et al (eds.), U. of Arizona, Tucson, AZ, 650-679, 1983.
- Taylor, V. R., and L.L. Stowe, "Reflectance Characteristics of Uniform Earth and Cloud Surfaces Derived from NIMBUS-7 ERB," *J. Geophys. Res.*, 89, 4987-4996, 1984.
- Turcotte, D.L., and D.C. McAdoo, "Geoid Anomalies and the Thickness of the Lithosphere," *J. Geophys. Res.*, 84, 2381-2387, 1979.
- Williams, B.G., N.A. Mottinger, and N.D. Panagiotacopulos, "Venus Gravity Field: Pioneer Venus Orbiter Navigation Results," *Icarus* 56, 578-589, 1983.
- Yoder, C.F., and W.R. Ward, "Does Venus Wobble?" *Astrophys. J.* 233, 33-37, 1979.
- Yoder, C.F., "Venus' Free Obliquity," *Icarus*, 117, 250-286, 1995.

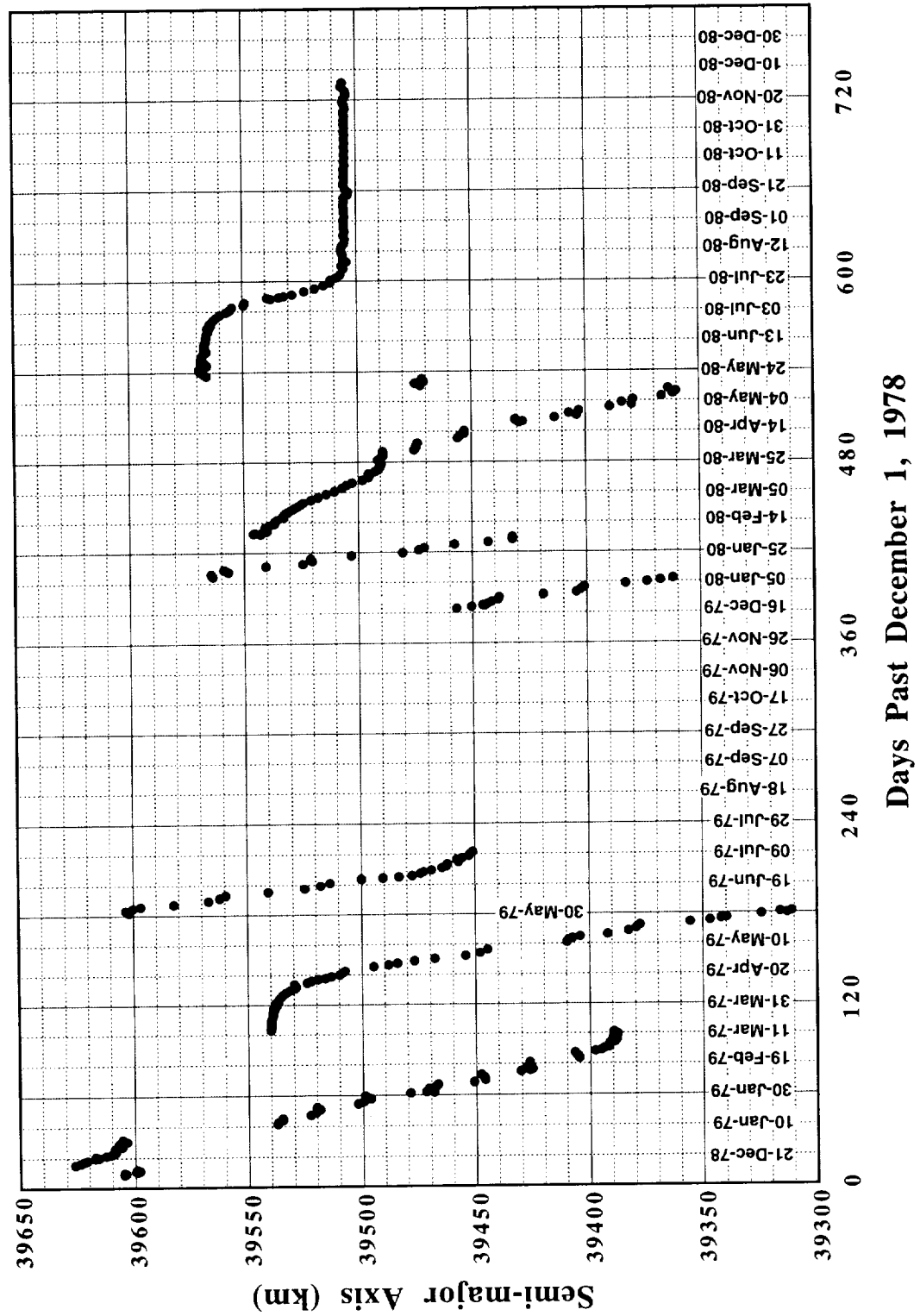
# **Appendix A**

## **PVO Low-Altitude Periapse Information**

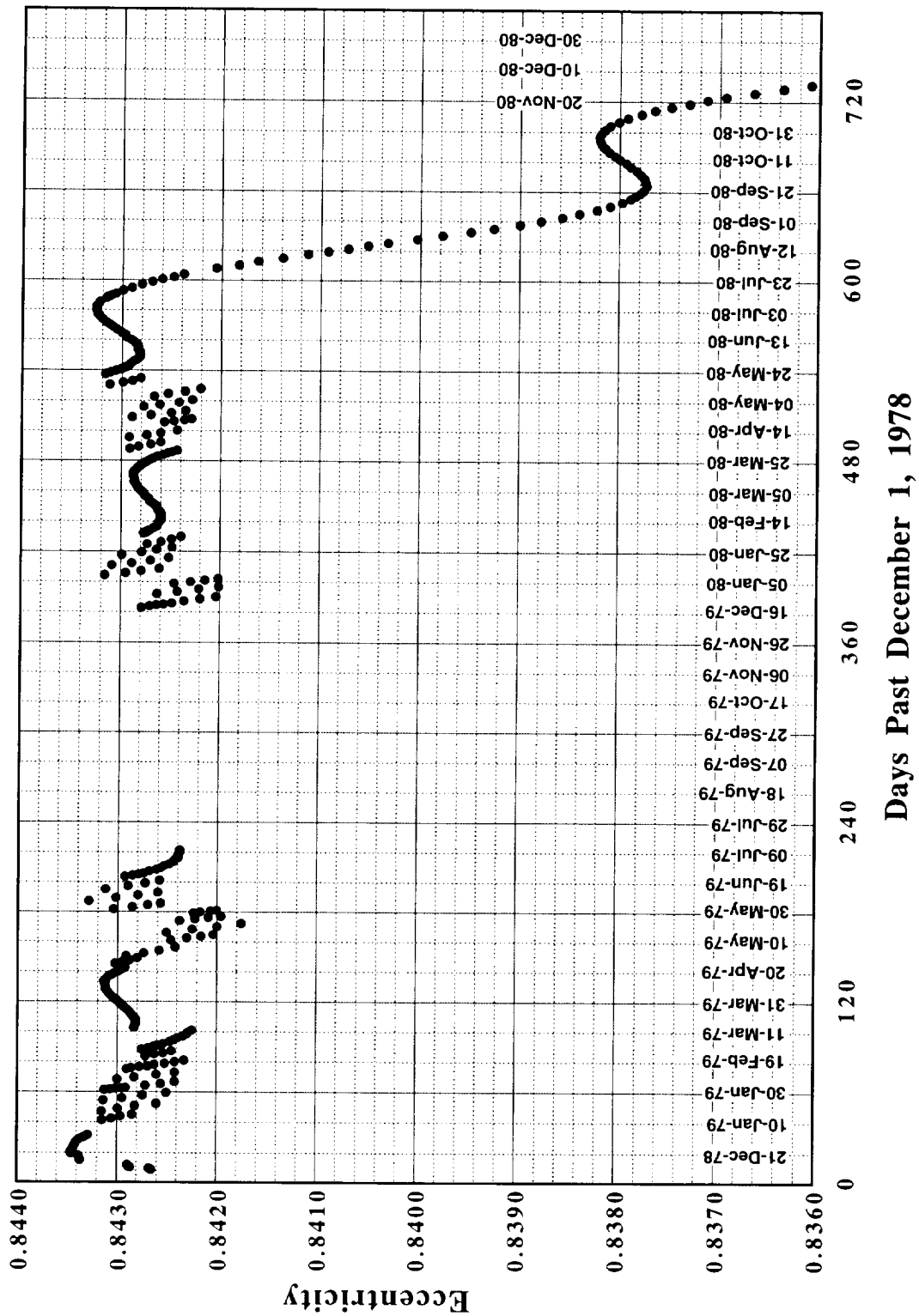
The following plots are included in this appendix:

1. Semi-major axis
2. Eccentricity
3. Inclination
4. Latitude at periapse
5. Longitude at periapse
6. Altitude at periapse
7. Plane-of-sky inclination
8. One-way light time from Venus to Earth
9. Sun-Earth-Venus angle
10. Earth-Venus-Probe at periapse angle
11. Local solar time at periapse
12. Altitude vs. latitude profile

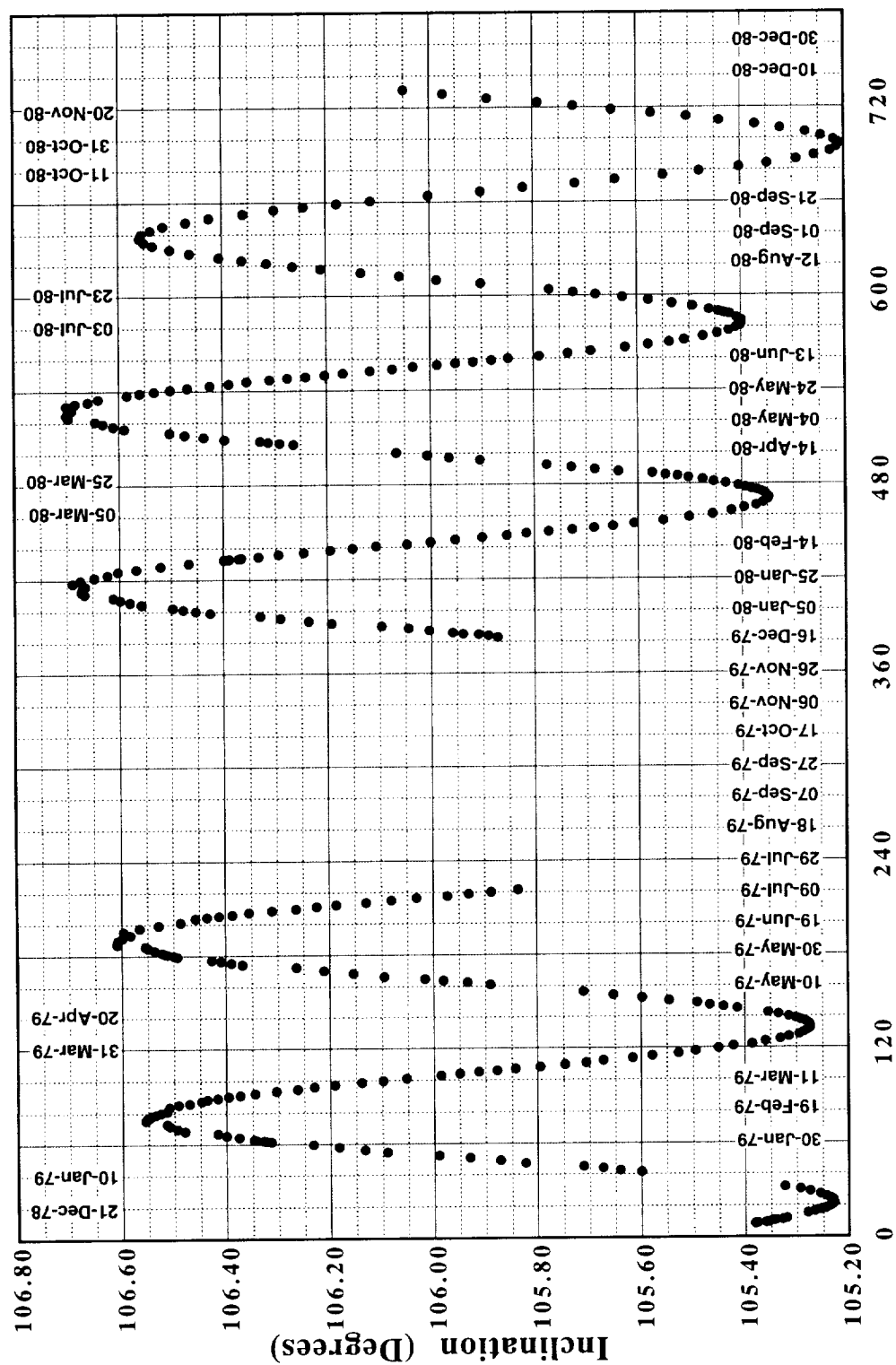
# PVO Low Orbit Semi-Major Axis



# PVO Low Orbit Eccentricity

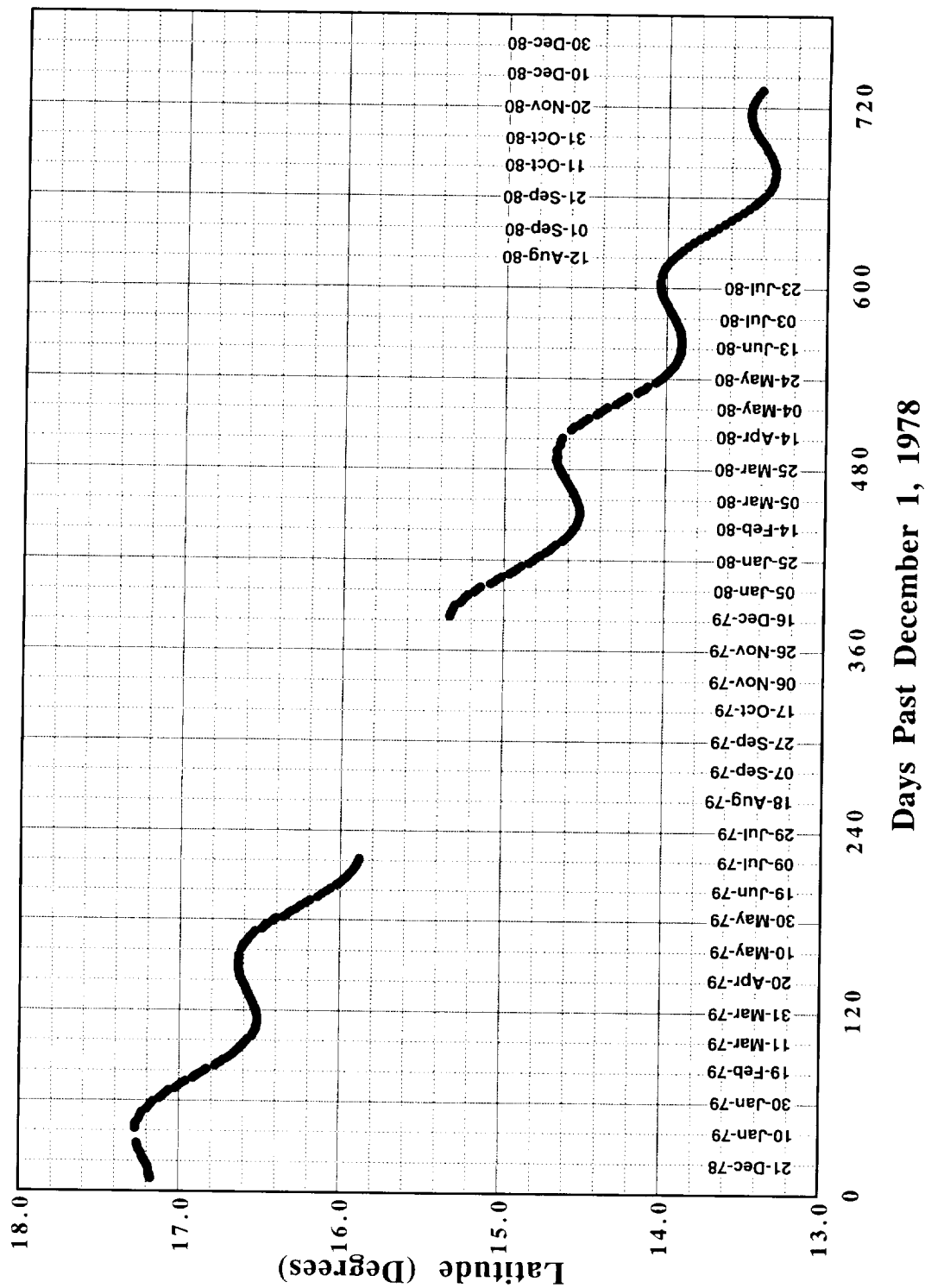


# PVO Low Orbit Inclination

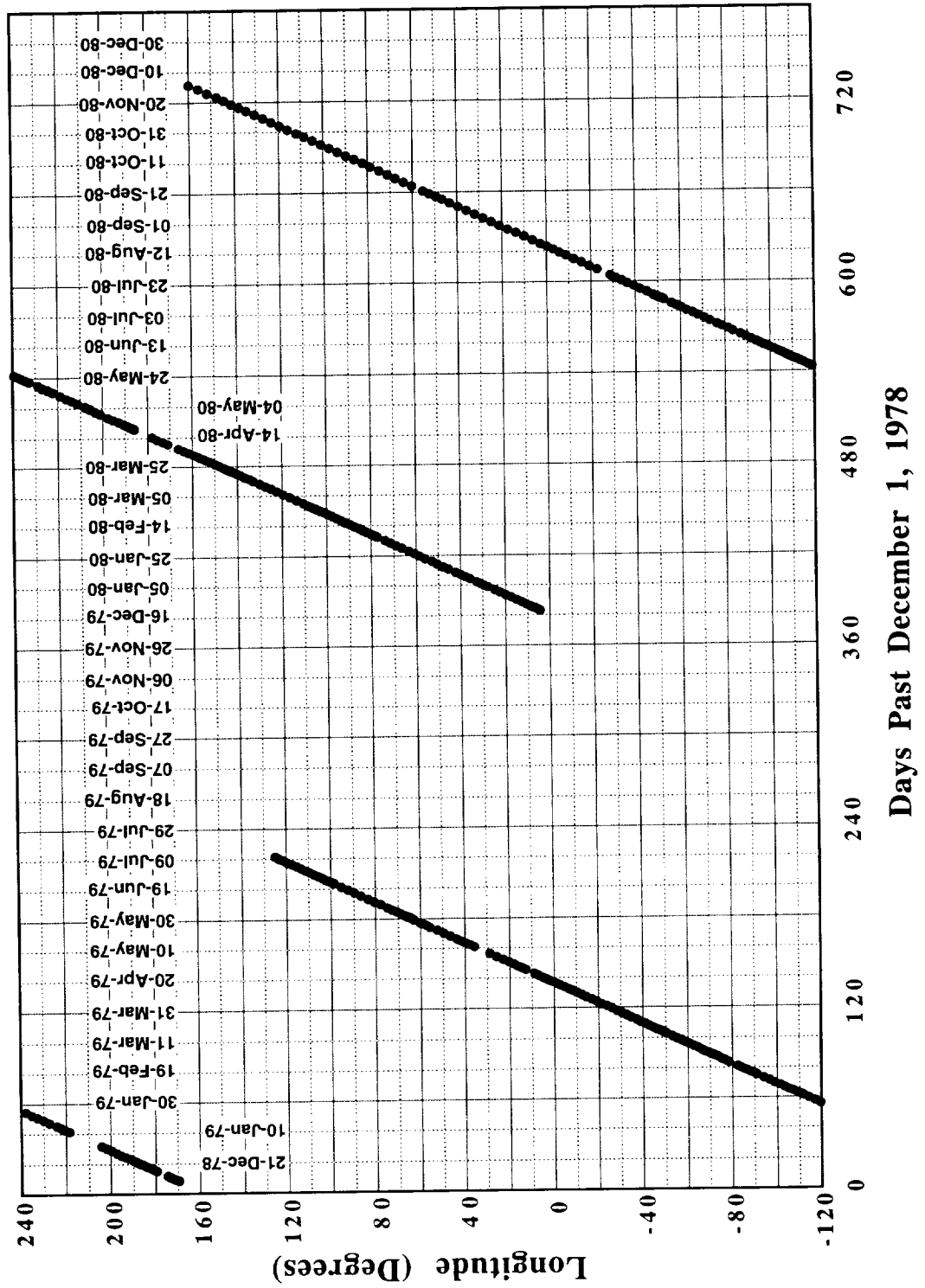


Days Past December 1, 1978

# PVO Low Orbit Latitude at Periapse

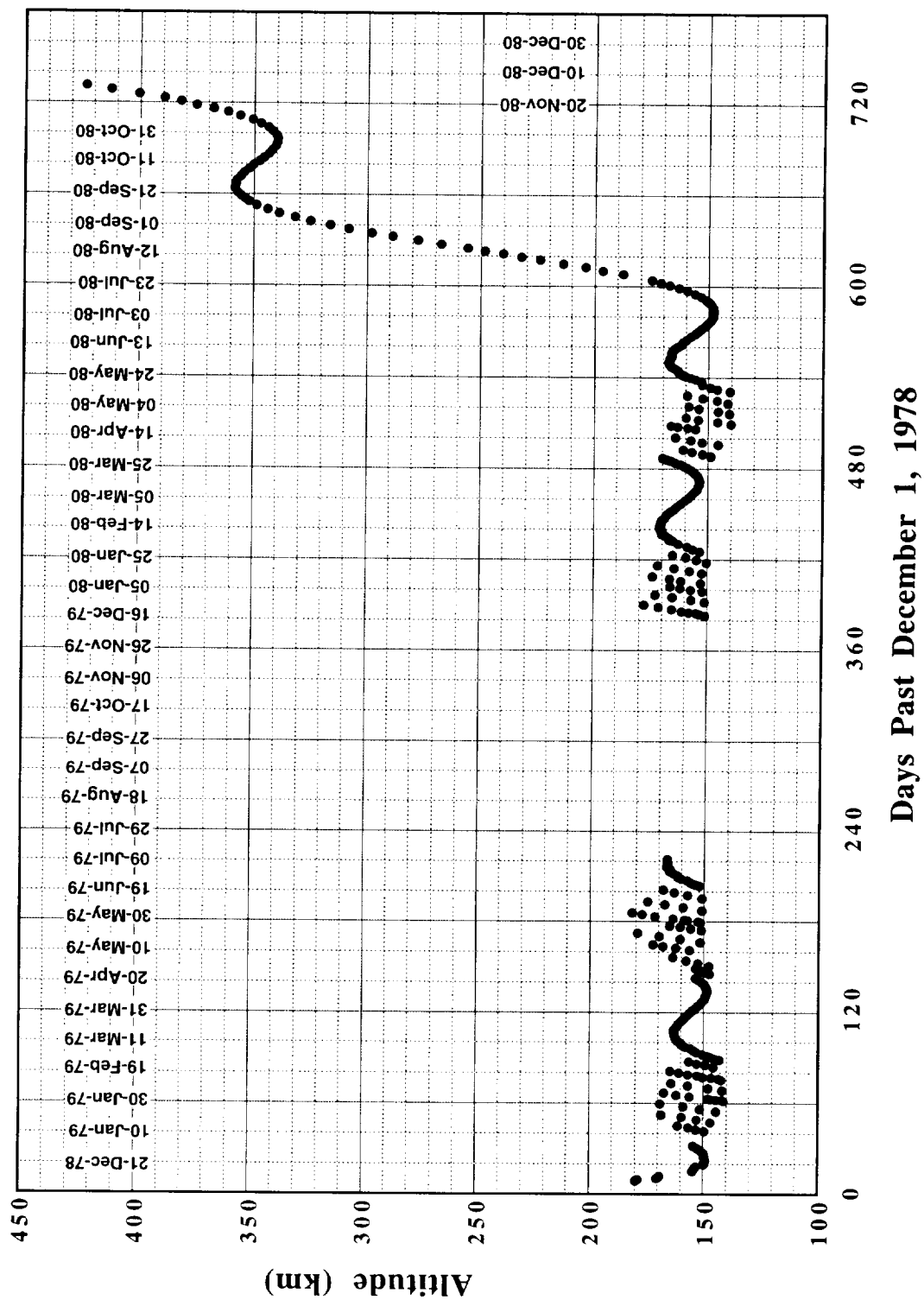


# PVO Low Orbit Longitude at Periapse

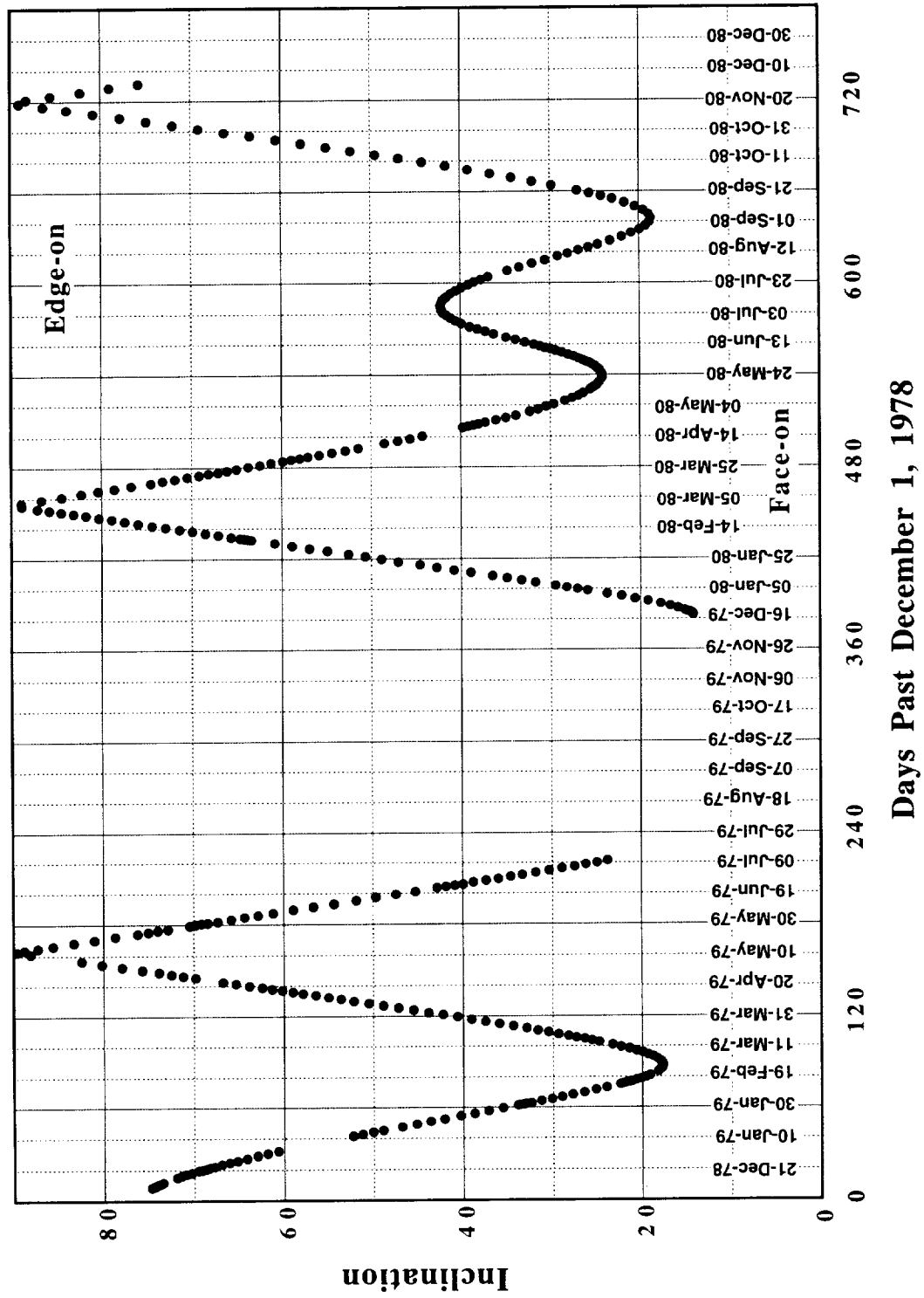




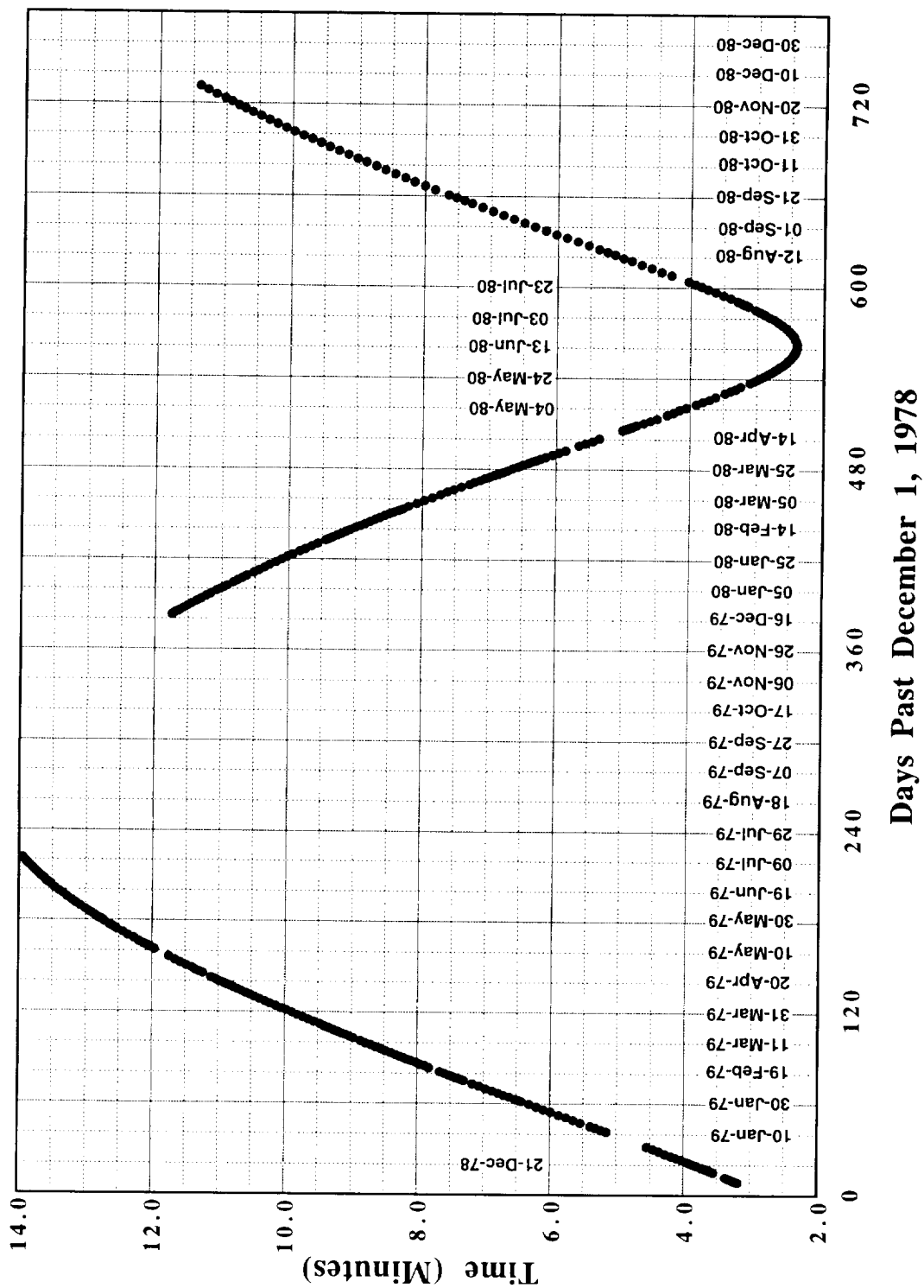
# PVO Low Orbit Altitude at Periapse



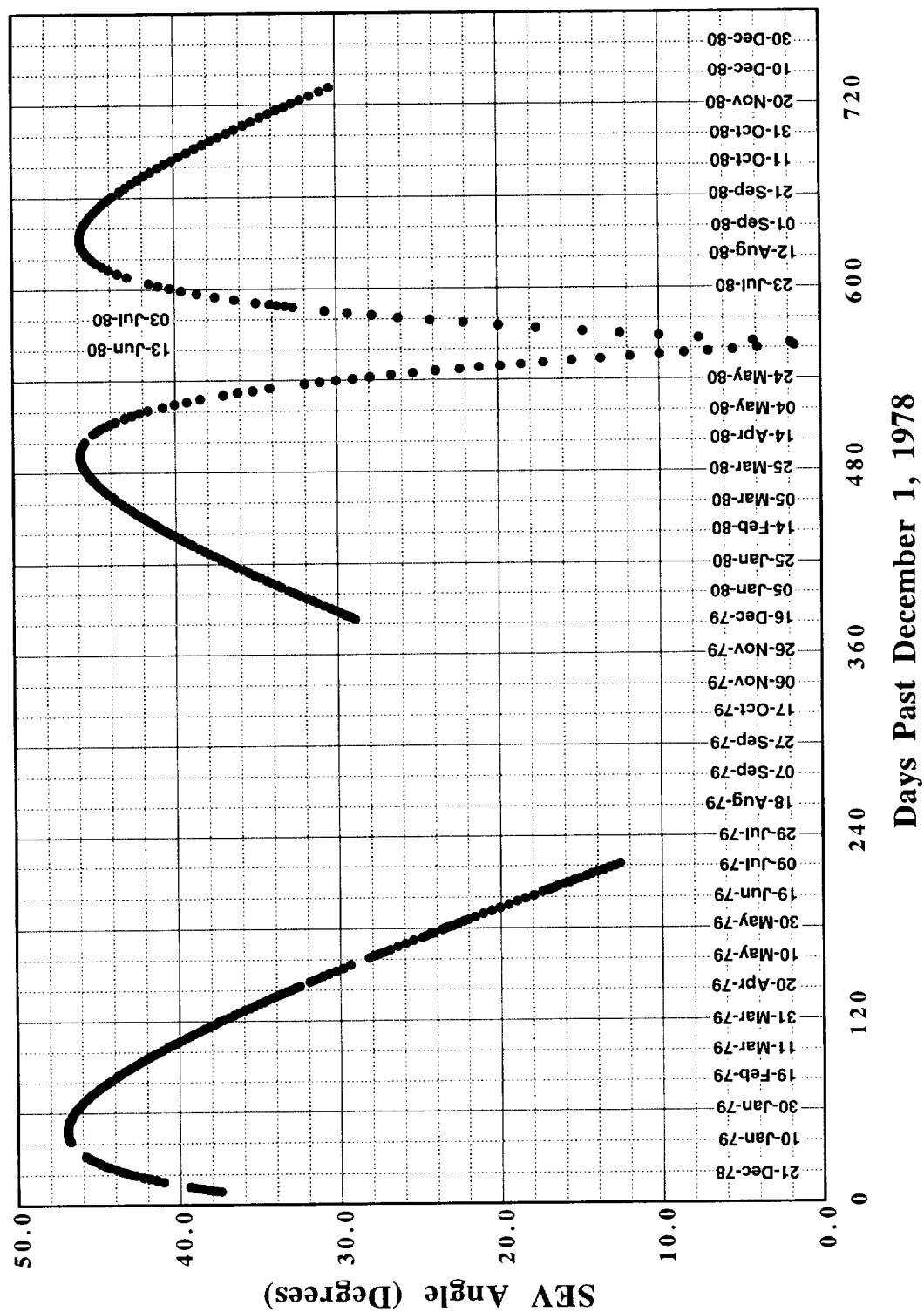
# PVO Low Orbit Plane-of-Sky Inclination



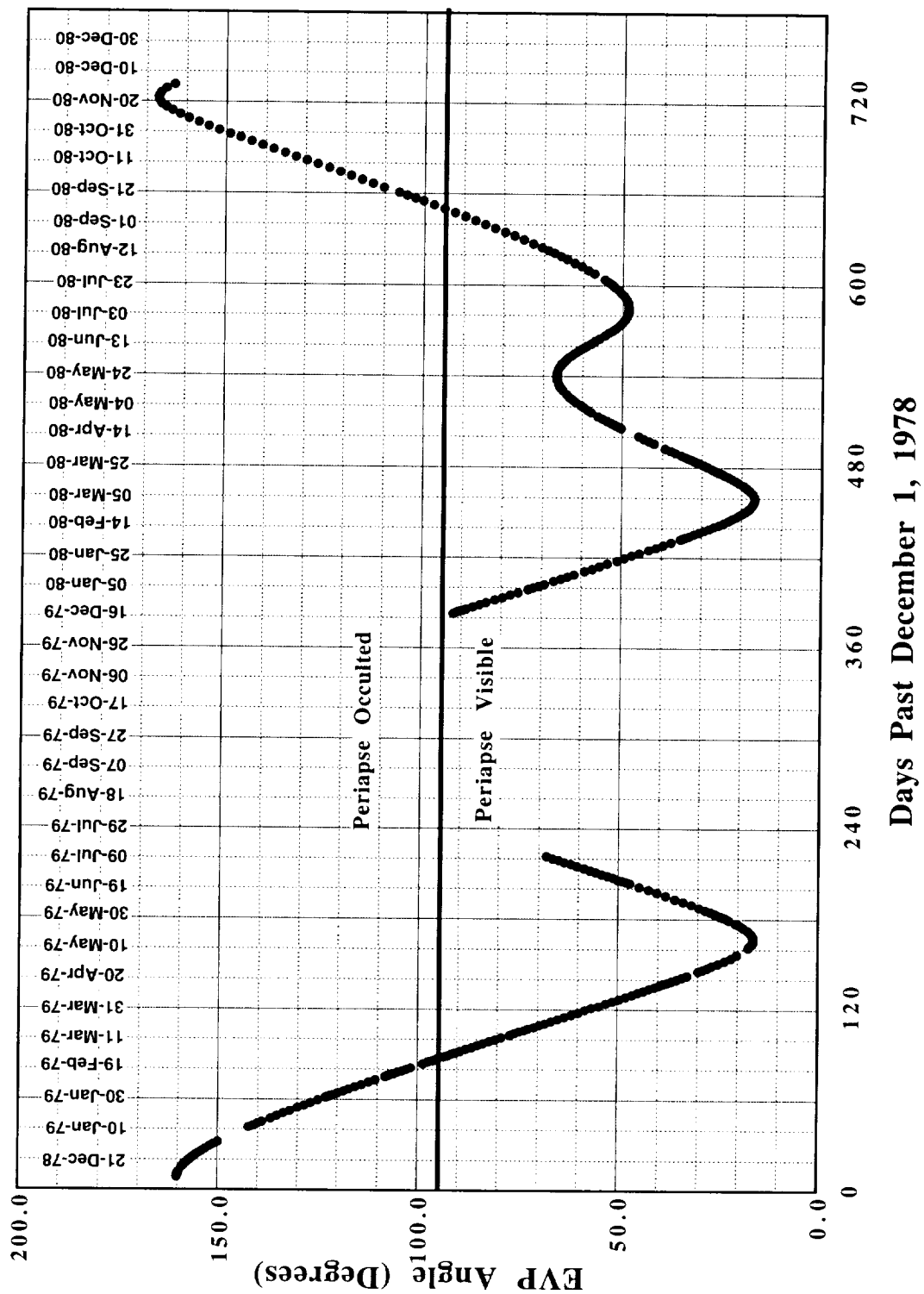
# PVO Low Orbit One-Way-Light-Time



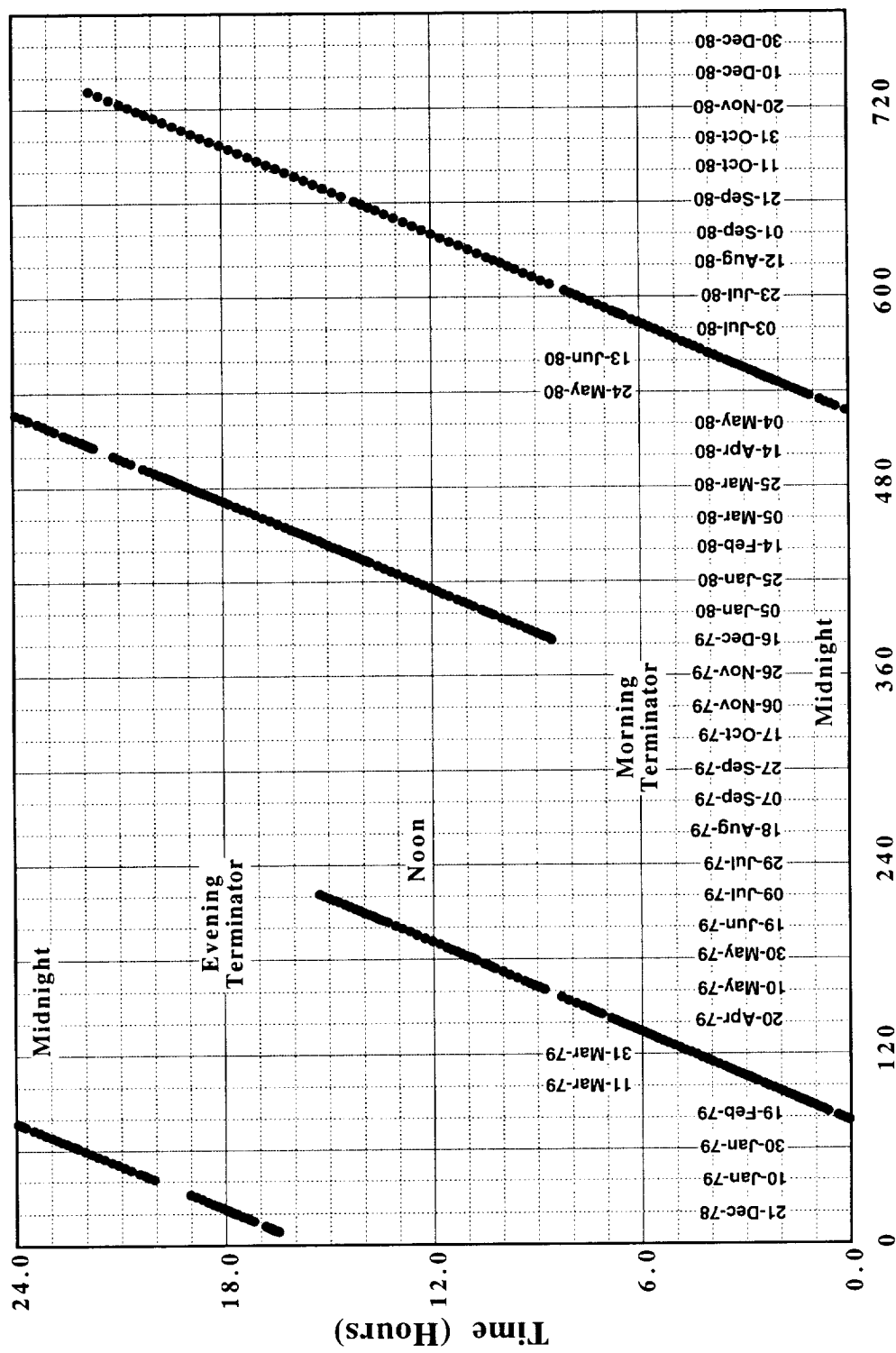
# PVO Low Orbit Sun-Earth-Venus Angle



# PVO Low Orbit Earth-Venus-Probe at Periapse Angle

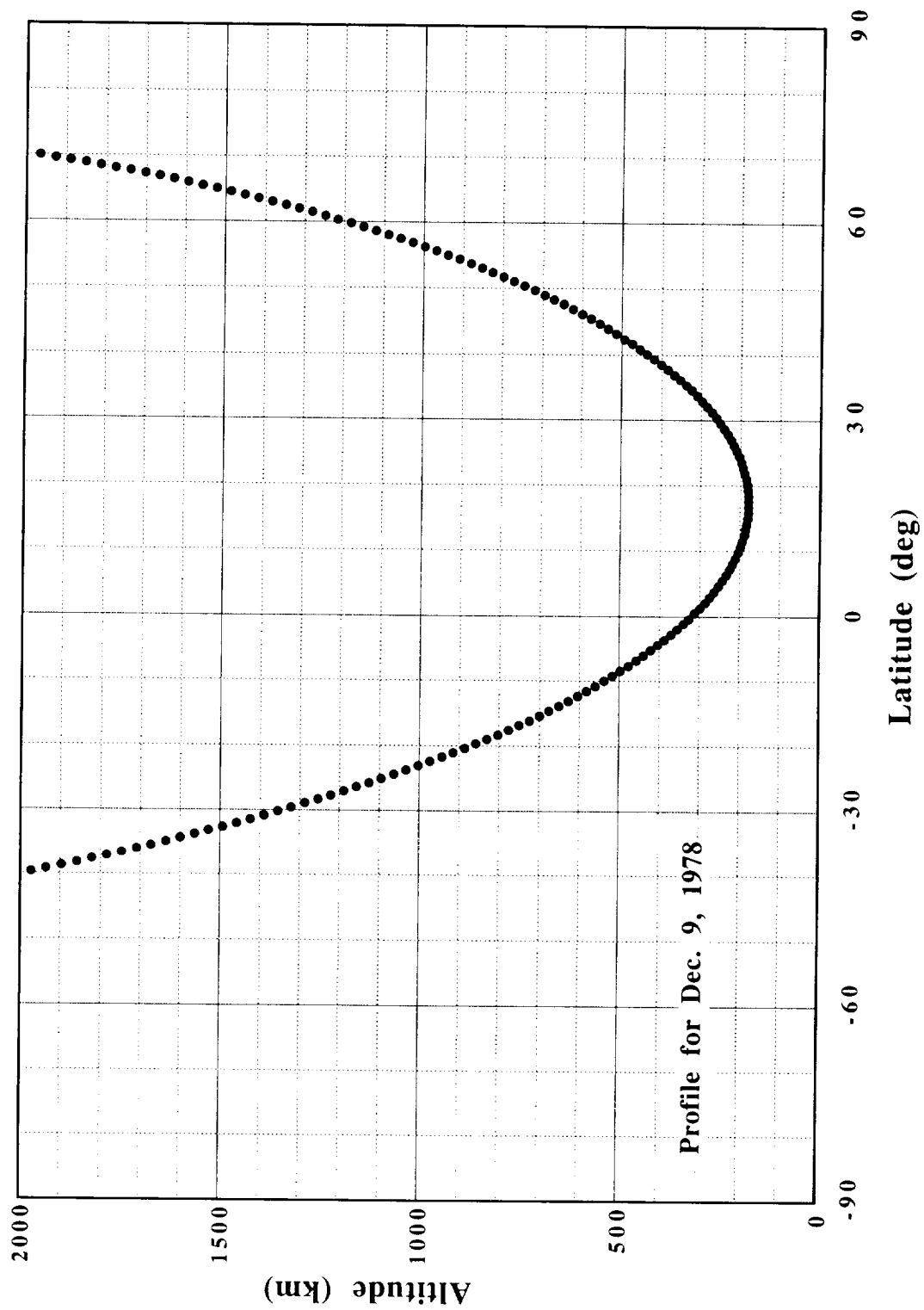


# PVO Low Orbit Local Solar Time at Periapse



Days Past December 1, 1978

# PVO Low Orbit Altitude vs Latitude







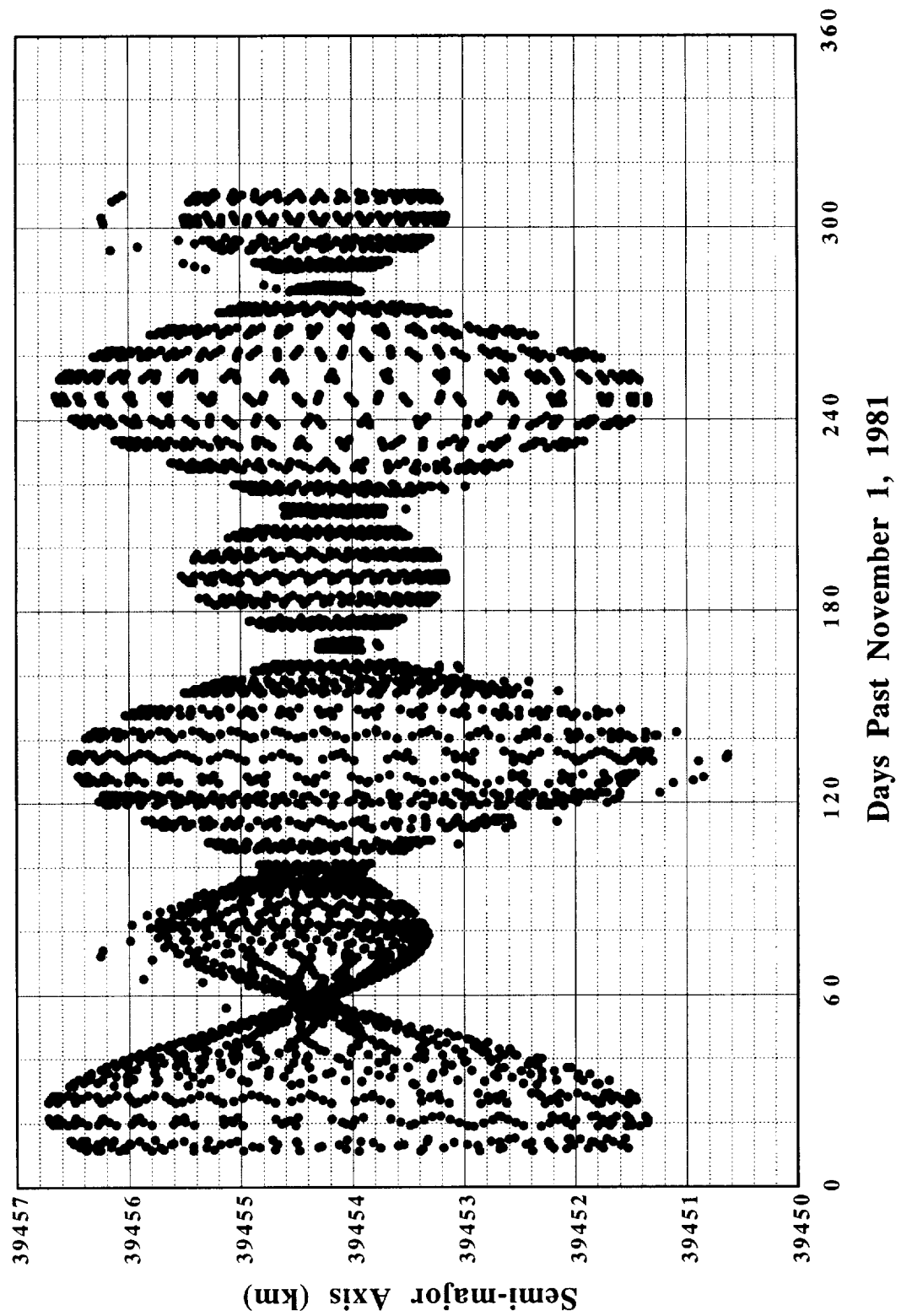
## **Appendix B**

### **PVO High-Altitude Periapse Information**

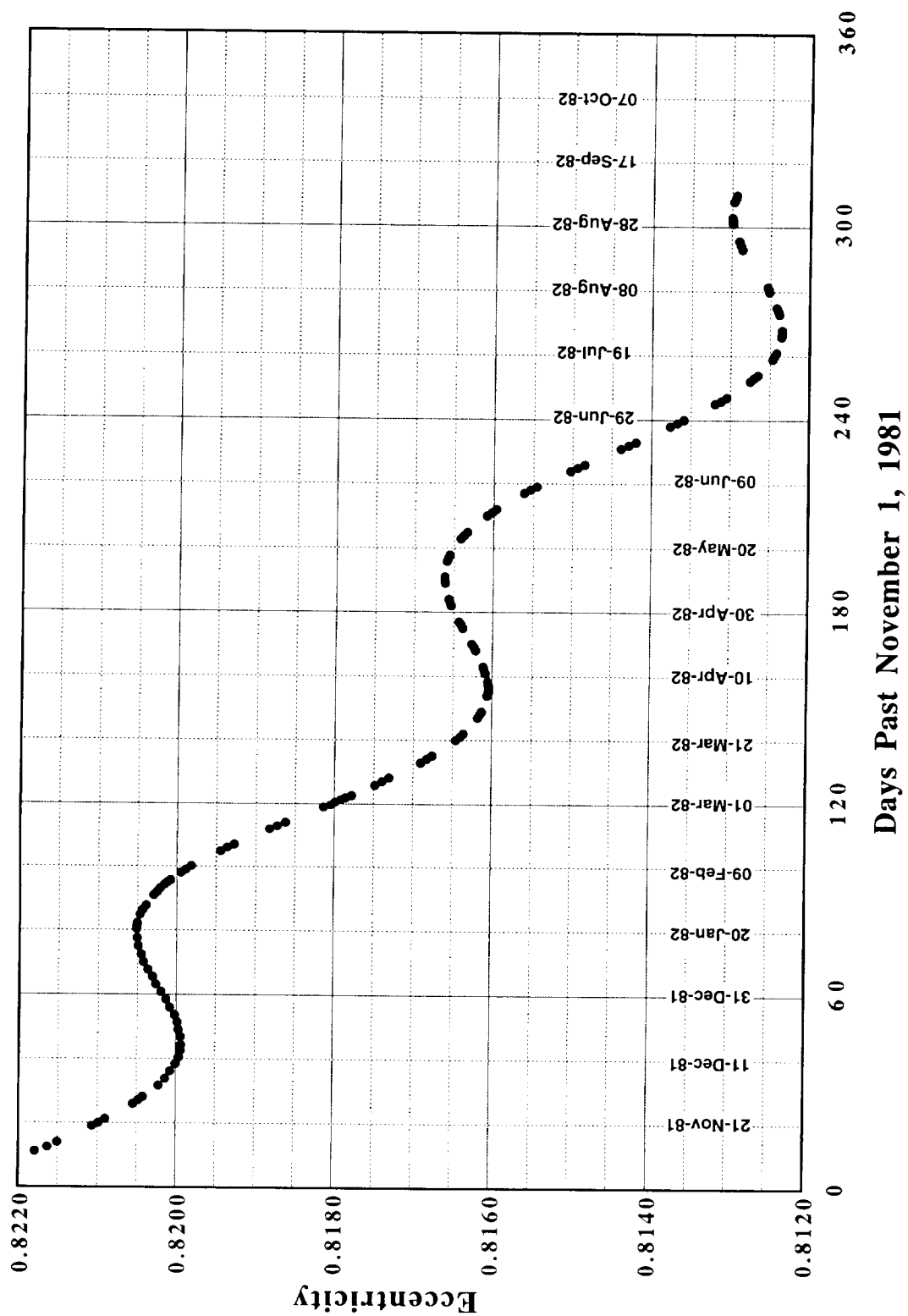
The following plots are included in this appendix:

1. Semi-major axis
2. Eccentricity
3. Inclination
4. Latitude at periapse
5. Longitude at periapse
6. Altitude at periapse
7. Plane-of-sky inclination
8. One-way light time from Venus to Earth
9. Sun-Earth-Venus angle
10. Earth-Venus-Sun angle
11. Earth-Venus-Probe at periapse angle
12. Local solar time at periapse

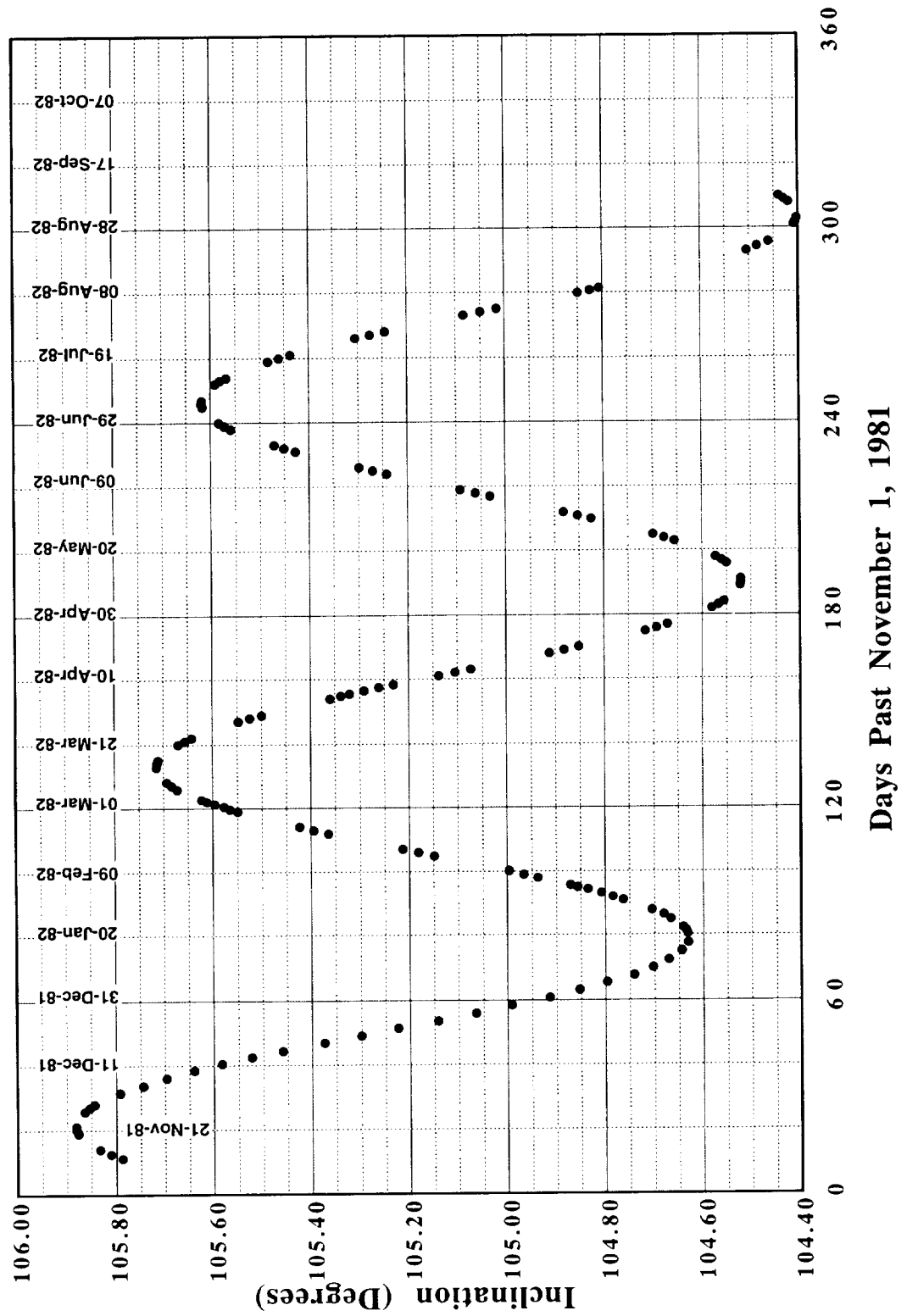
# PVO High Orbit Semi-Major Axis



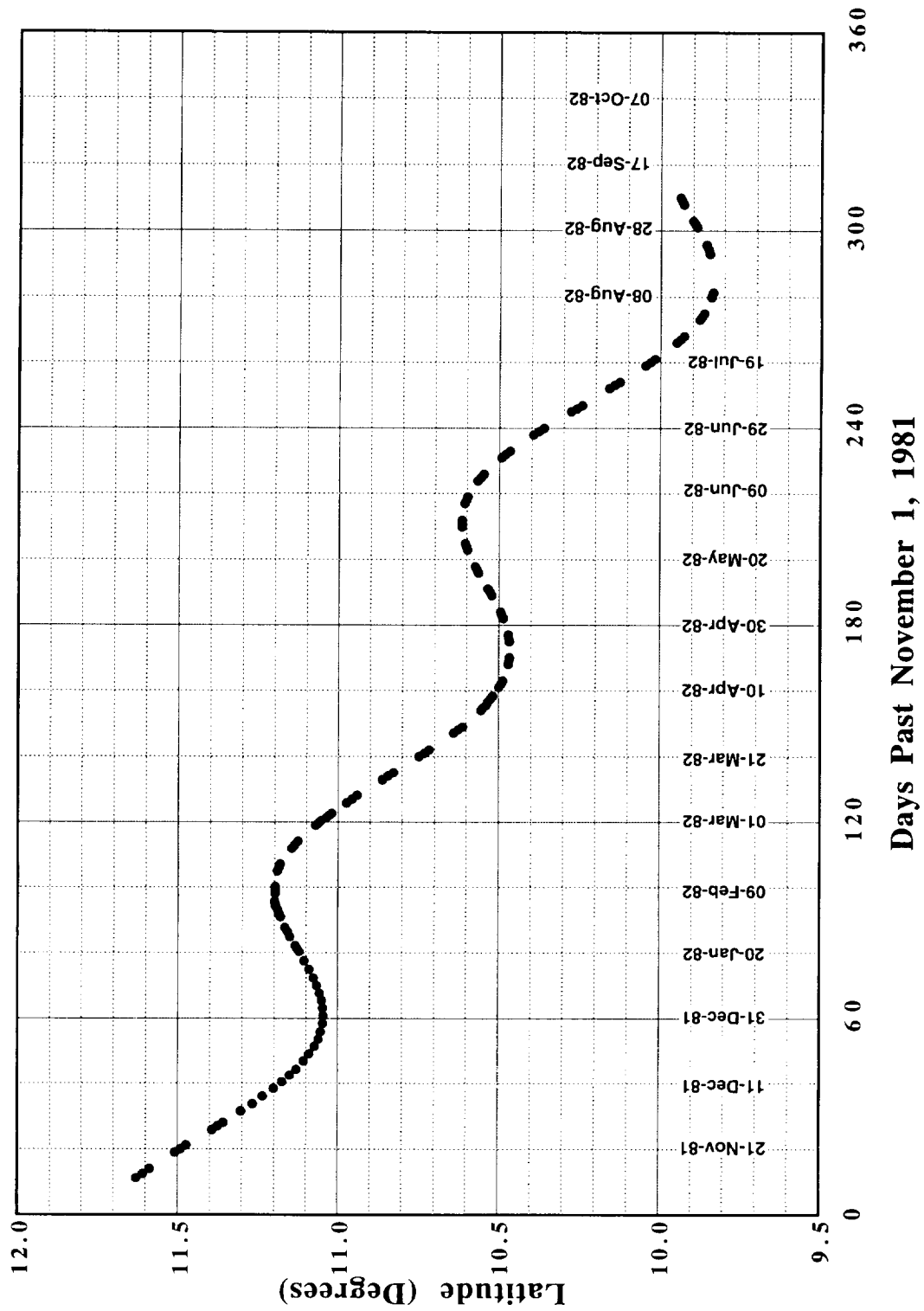
# PVO High Orbit Eccentricity



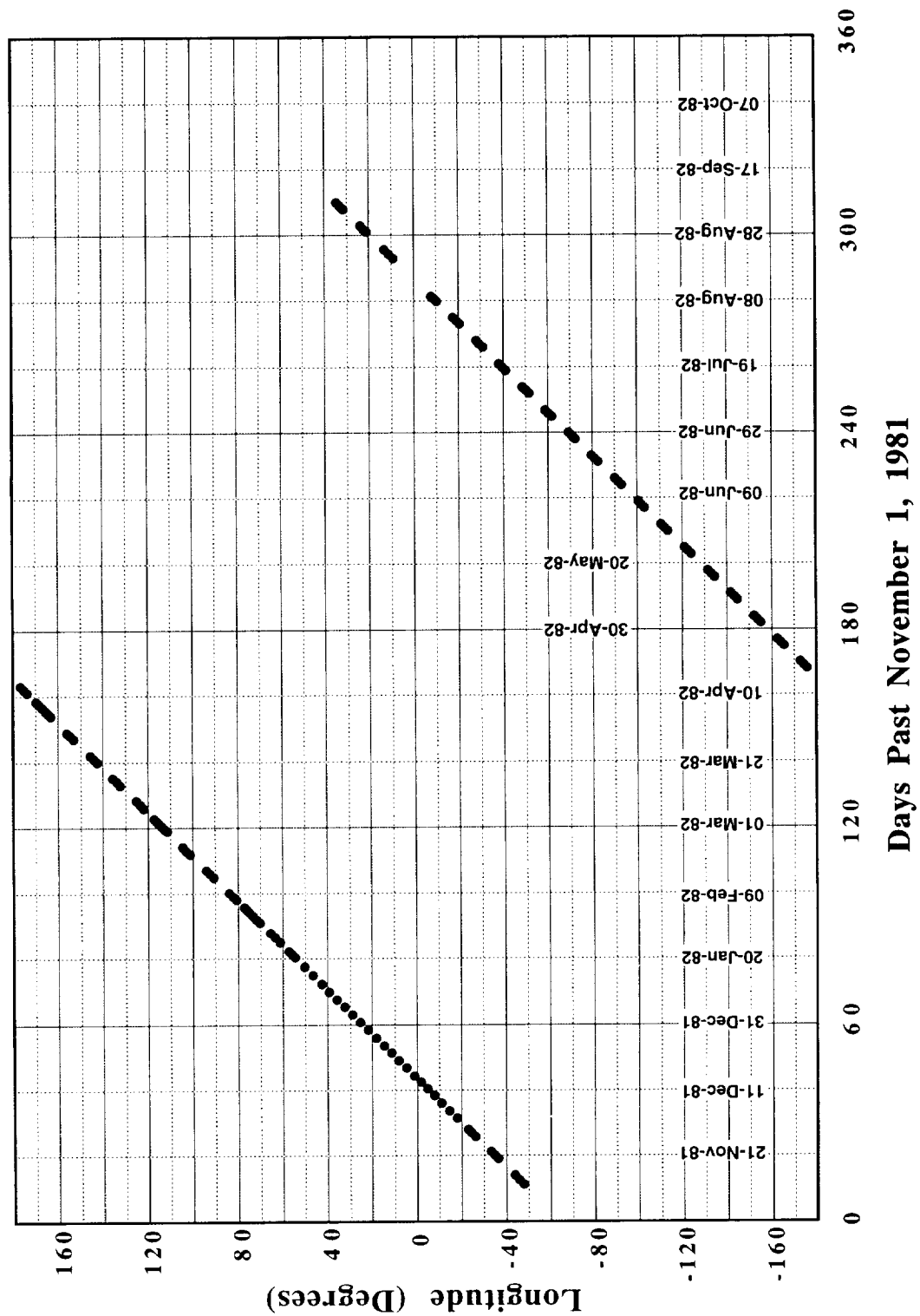
# PVO High Orbit Inclination



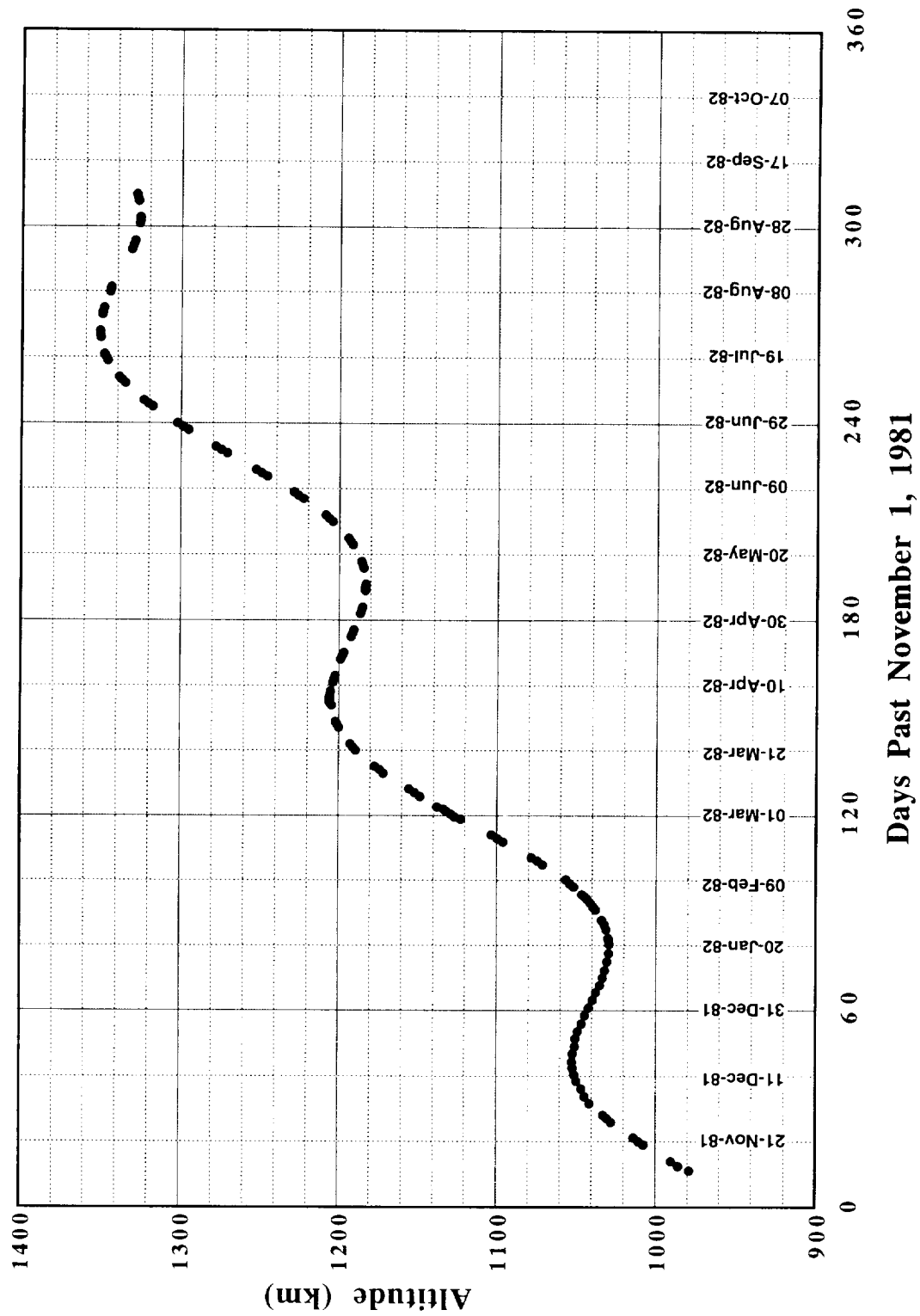
# PVO High Orbit Latitude at Periapse



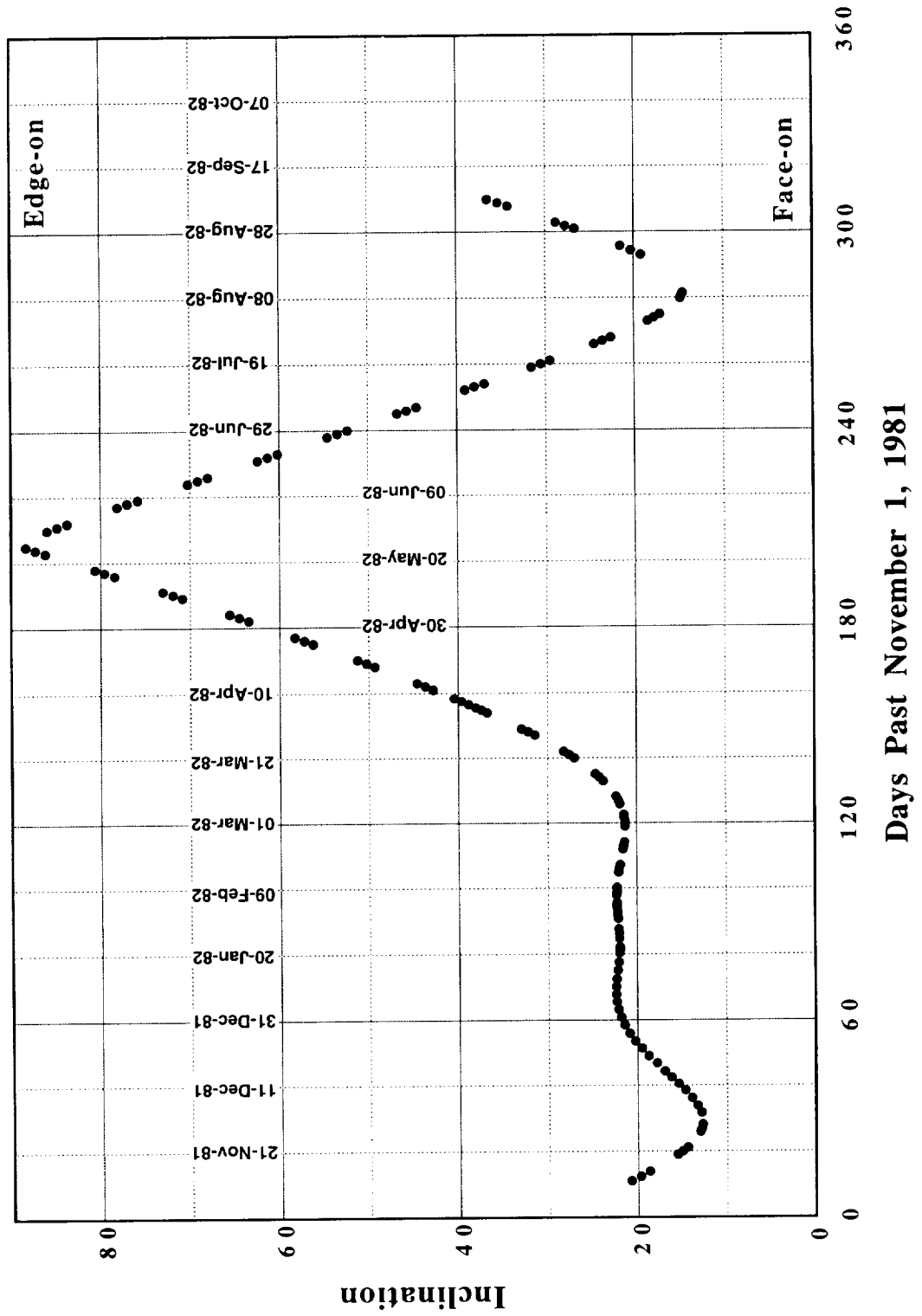
# PVO High Orbit Longitude at Periapse



# PVO High Orbit Altitude at Periapse

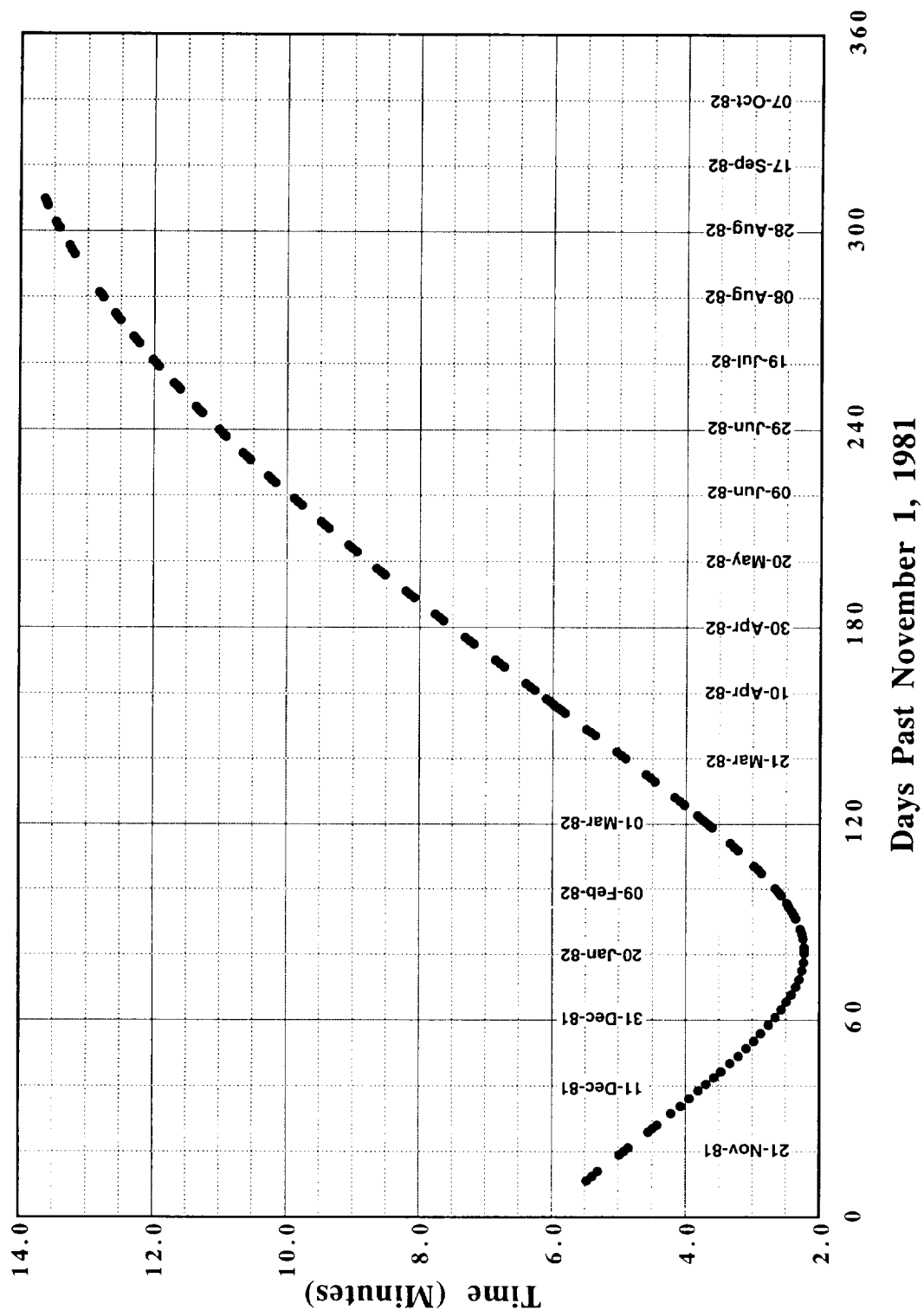


# PVO High Orbit Plane-of-Sky Inclination

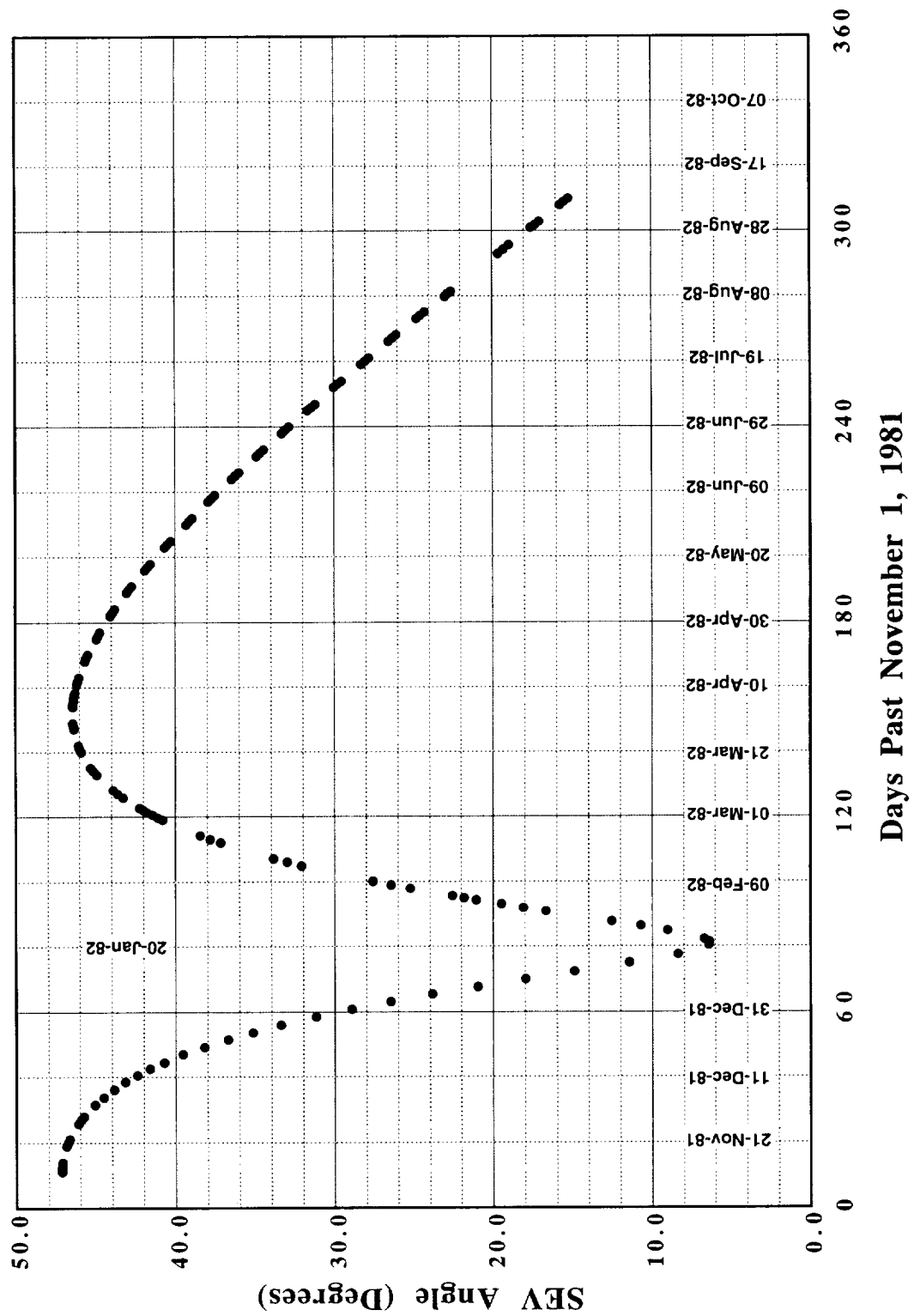




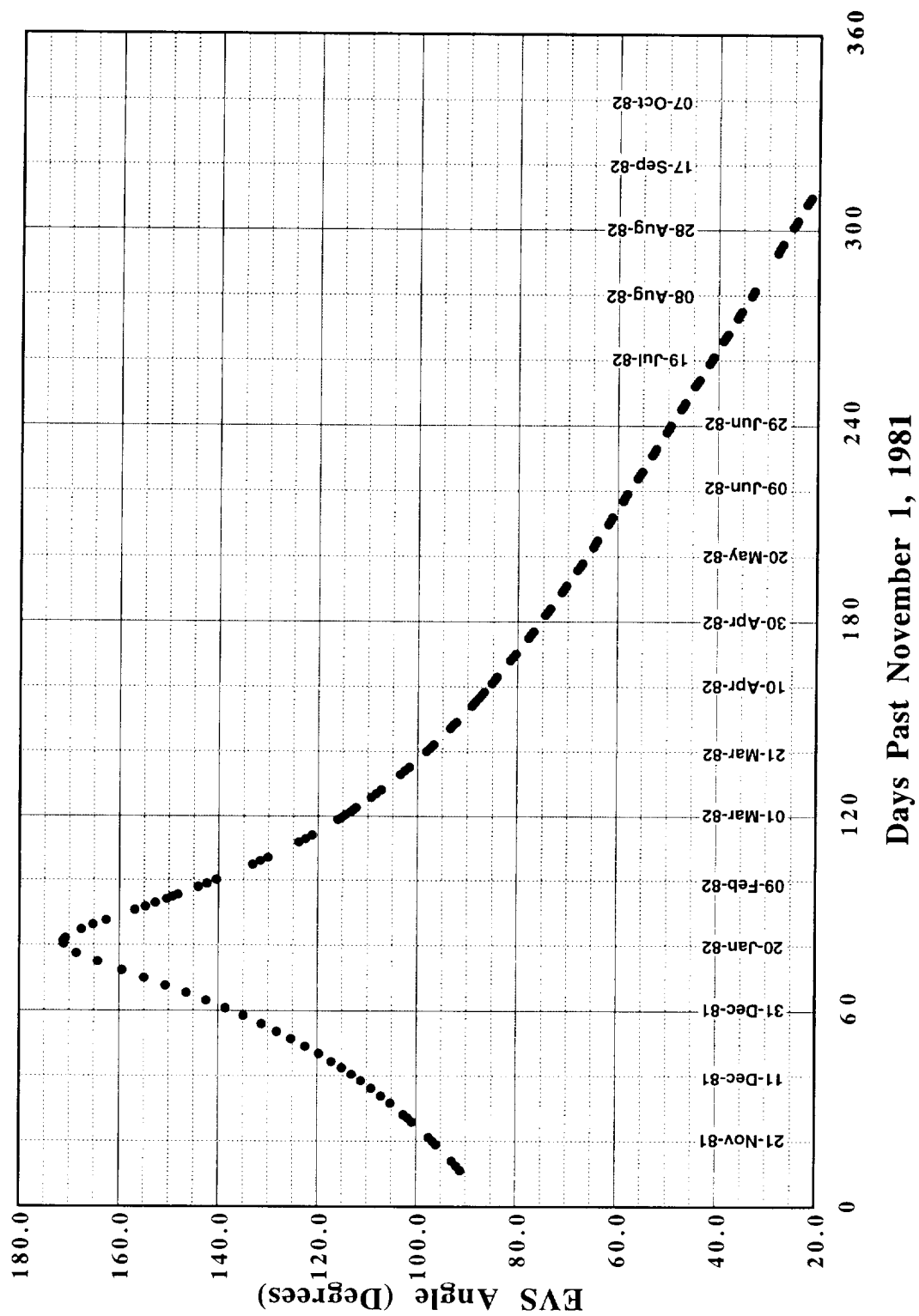
# PVO High Orbit One-Way-Light-Time



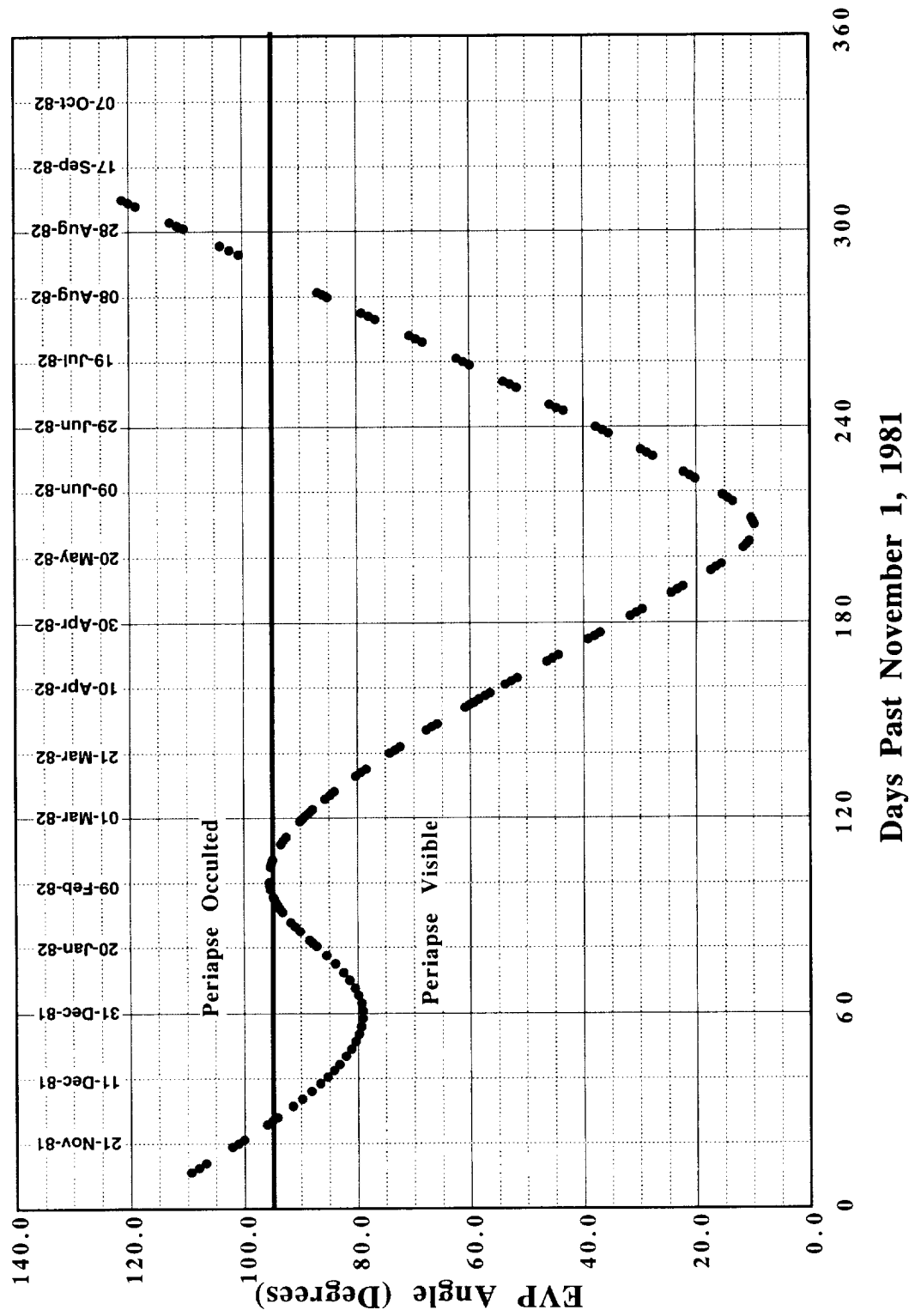
# PVO High Orbit Sun-Earth-Venus Angle



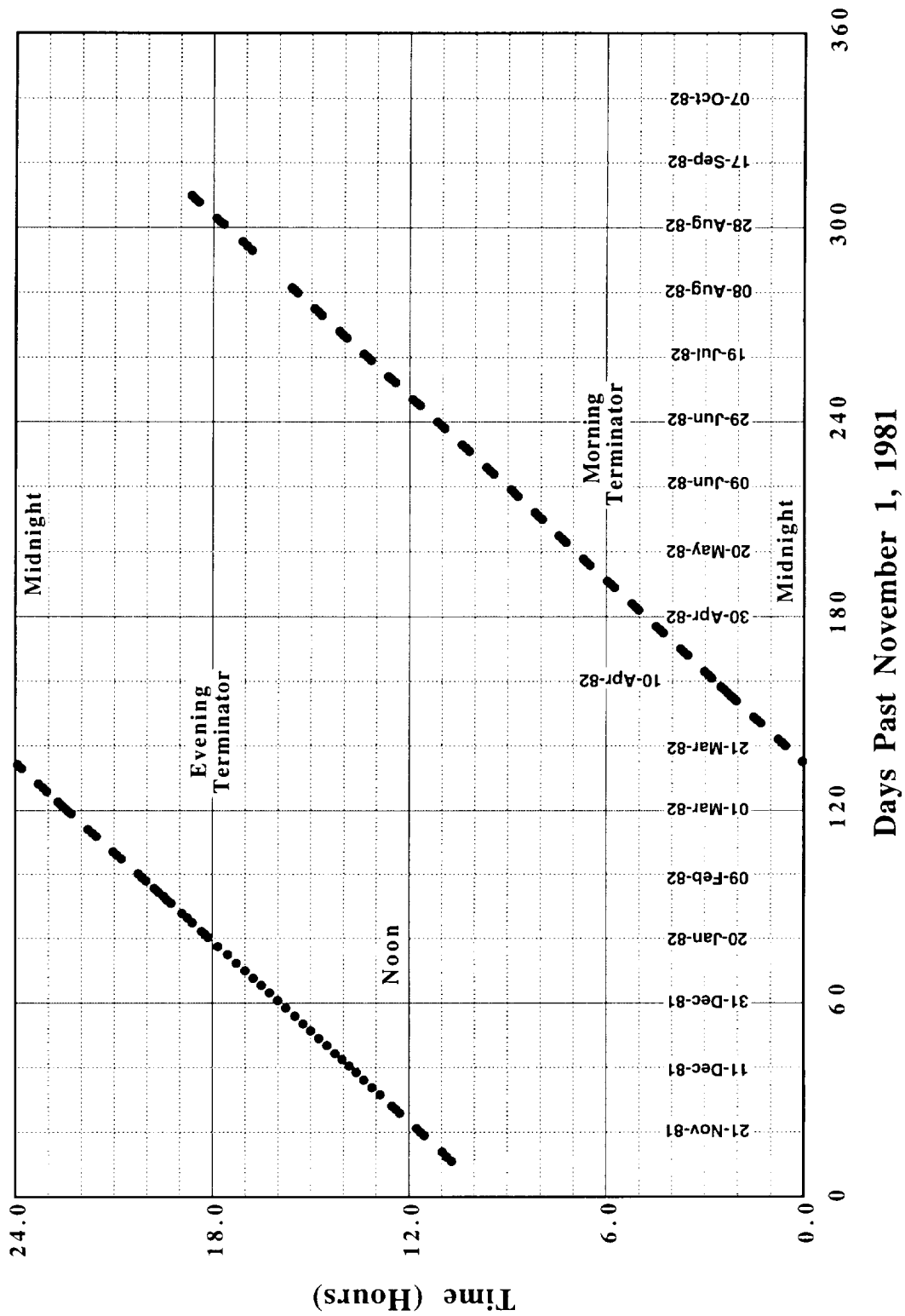
# PVO High Orbit Earth-Venus-Sun Angle



# PVO High Orbit Earth-Venus-Probe at Periapse Angle



# PVO High Orbit Local Solar Time at Periapse





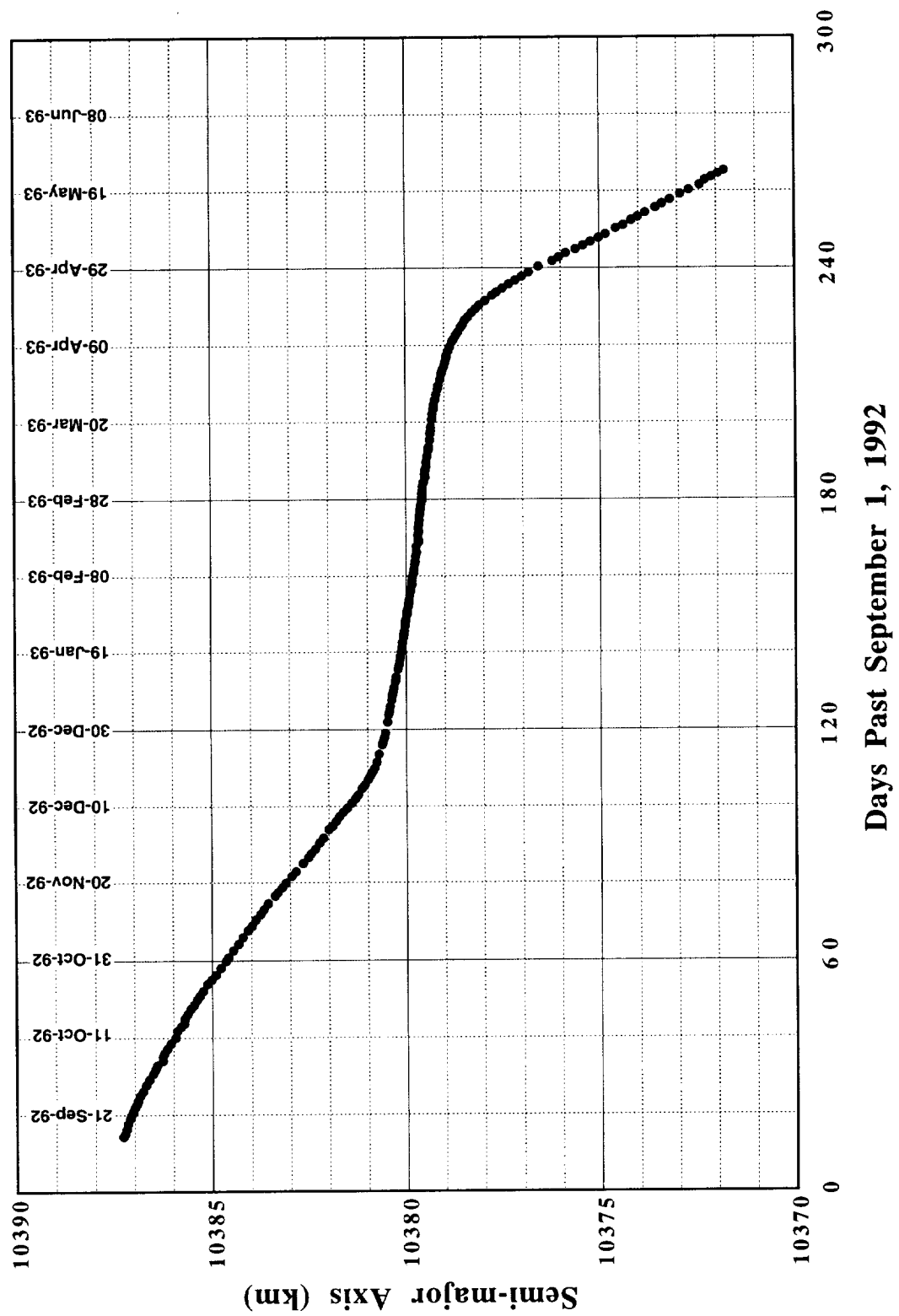
## **Appendix C**

### **Magellan Cycle 4 (Elliptical) Information**

The following plots are included in this appendix:

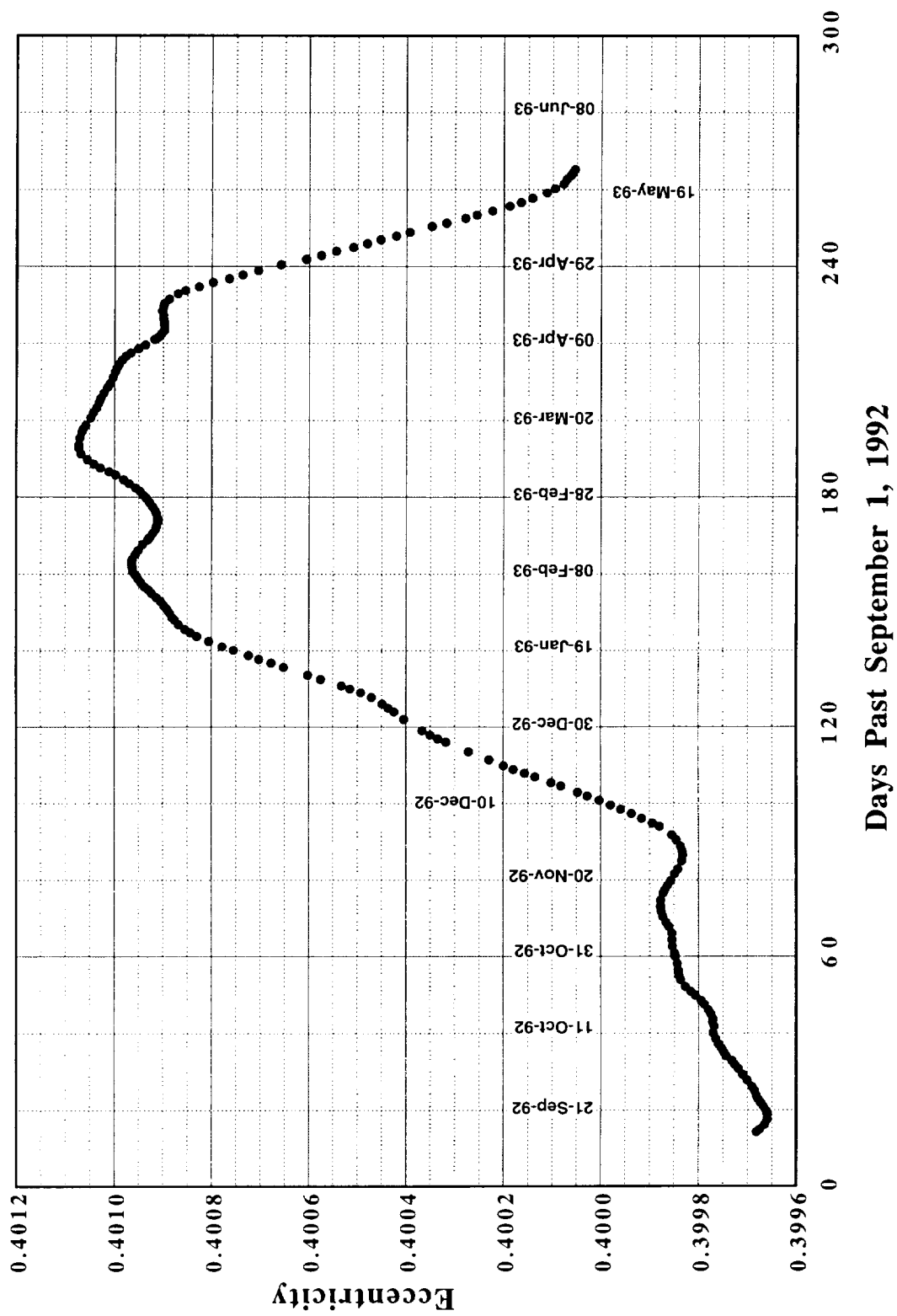
1. Semi-major axis
2. Eccentricity
3. Inclination
4. Latitude at periapse
5. Longitude at periapse
6. Altitude at periapse
7. Plane-of-sky inclination vs time
8. Plane-of-sky inclination vs longitude
9. One-way light time from Venus to Earth
10. Sun-Earth-Venus angle
11. Earth-Venus-Probe at periapse angle
12. Local solar time at periapse
13. Altitude vs. latitude profile

# Magellan Cycle 4 Semi-Major Axis

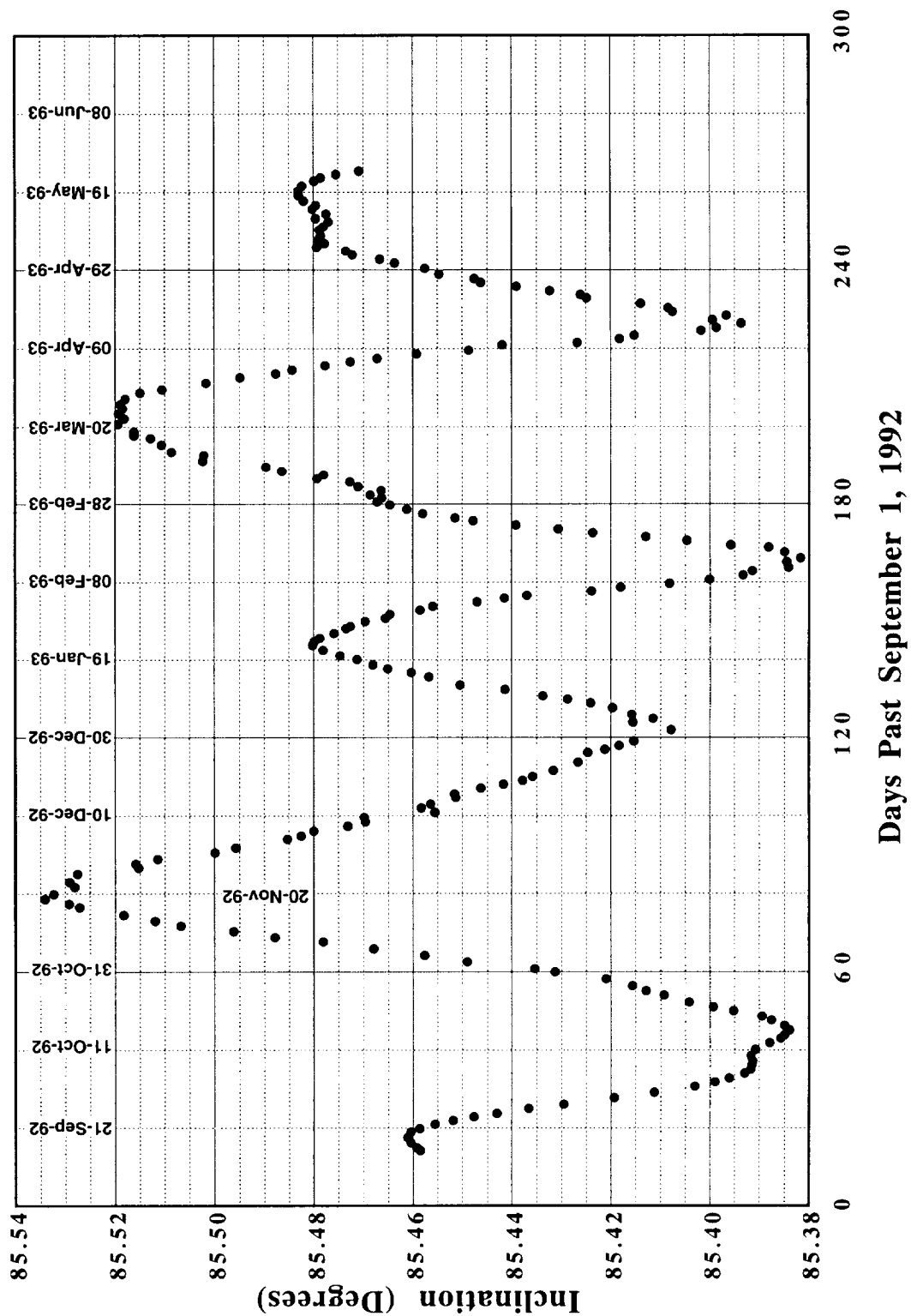




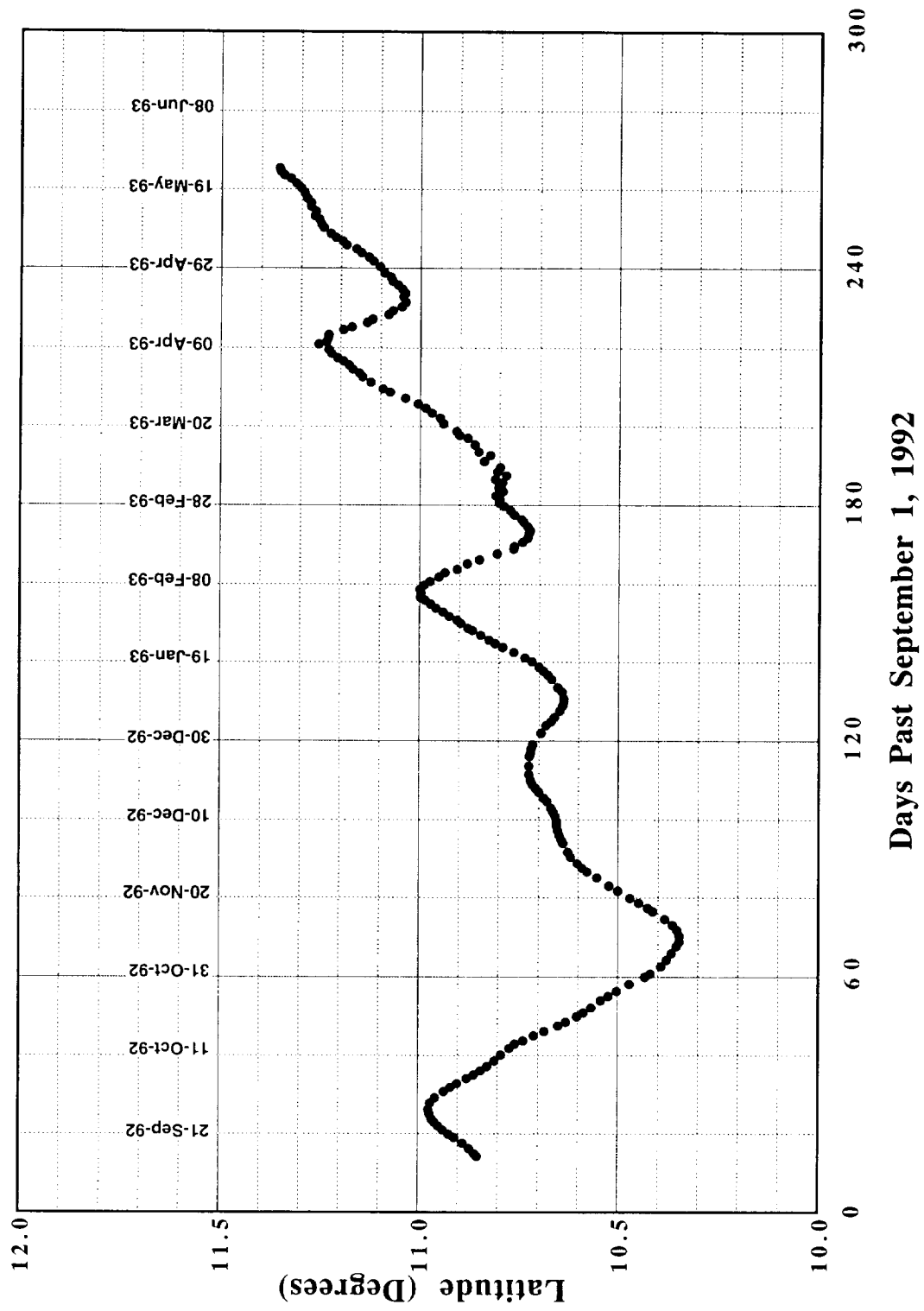
# Magellan Cycle 4 Eccentricity



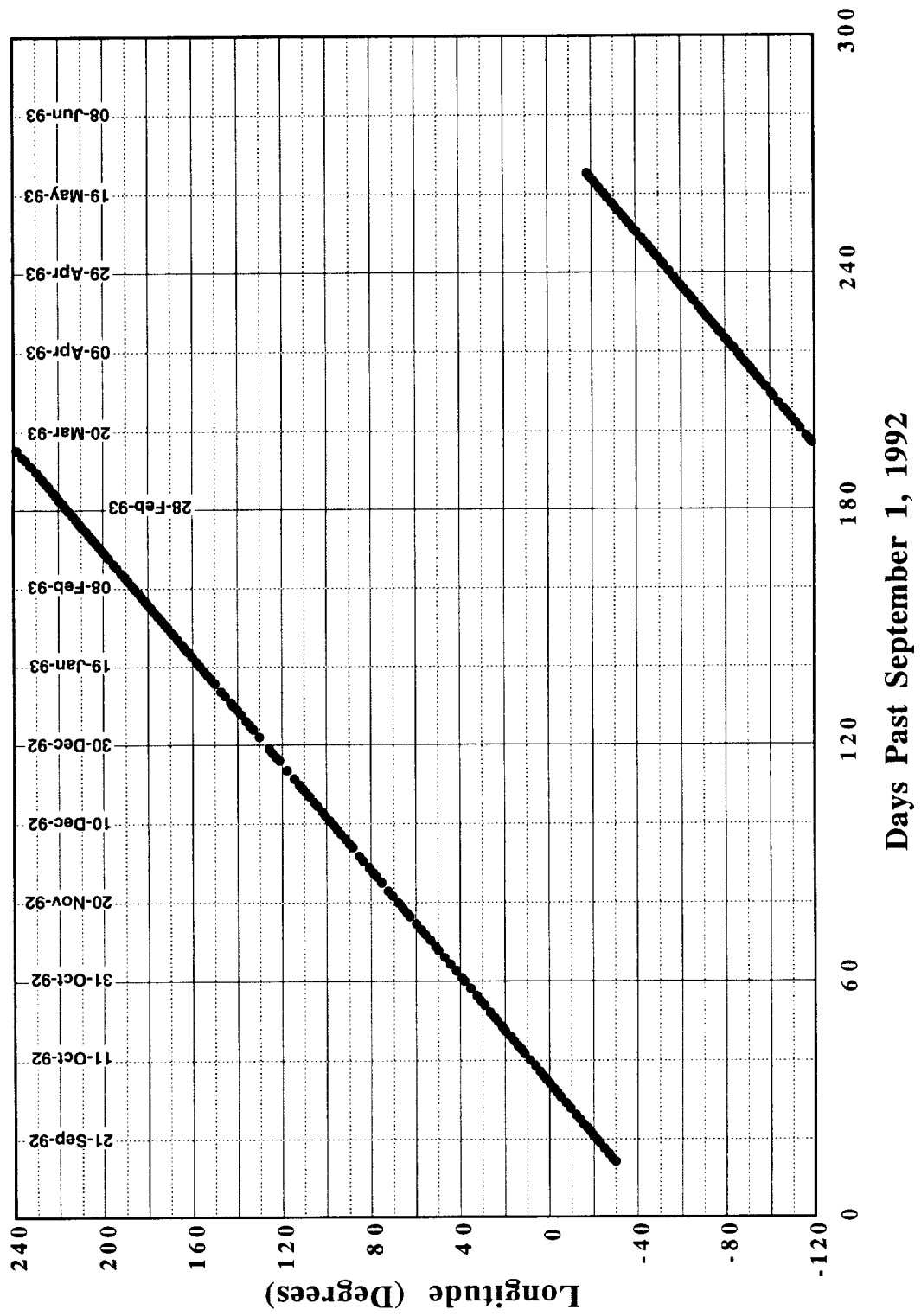
# Magellan Cycle 4 Inclination



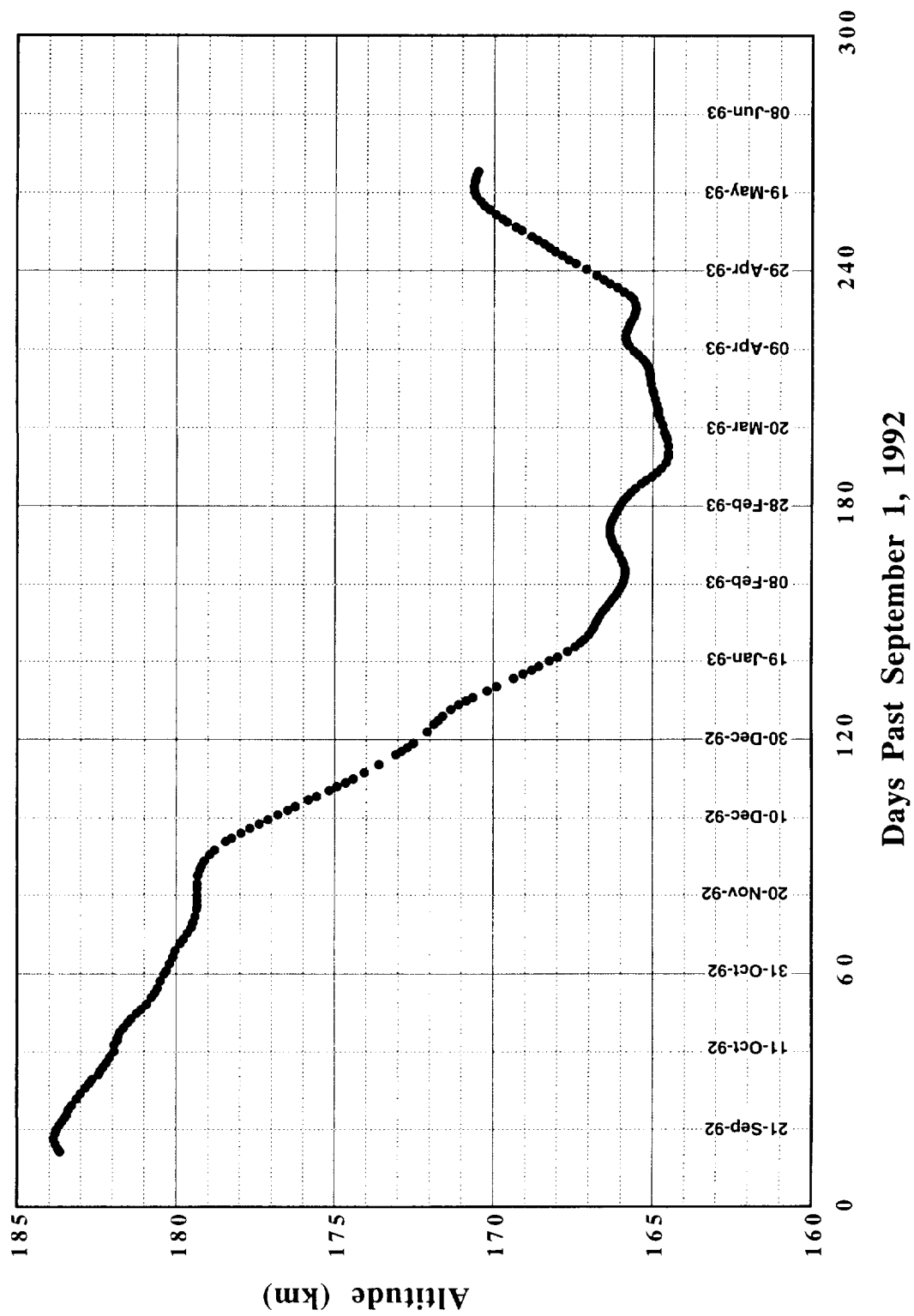
# Magellan Cycle 4 Latitude at Periapse



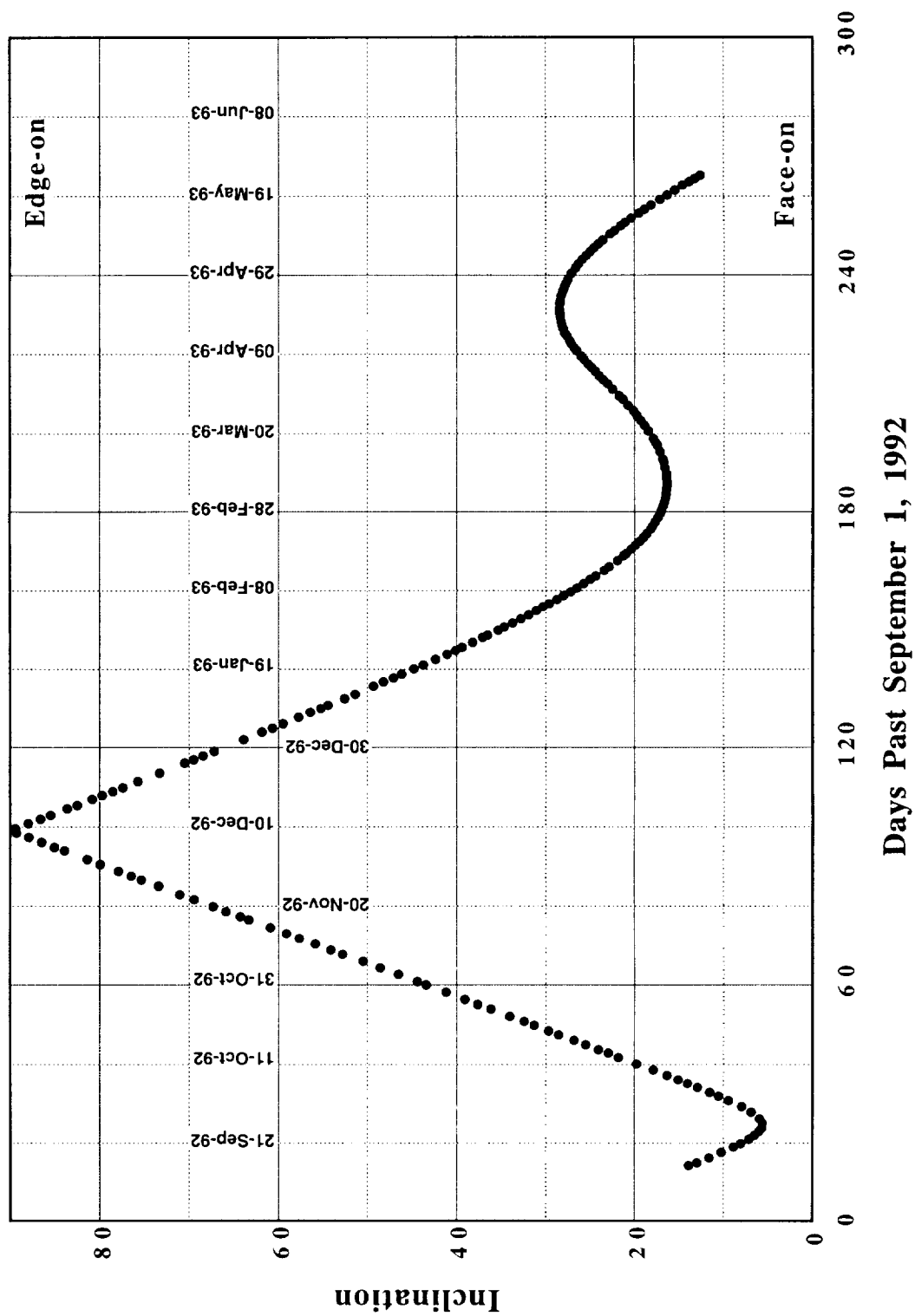
# Magellan Cycle 4 Longitude at Periapse



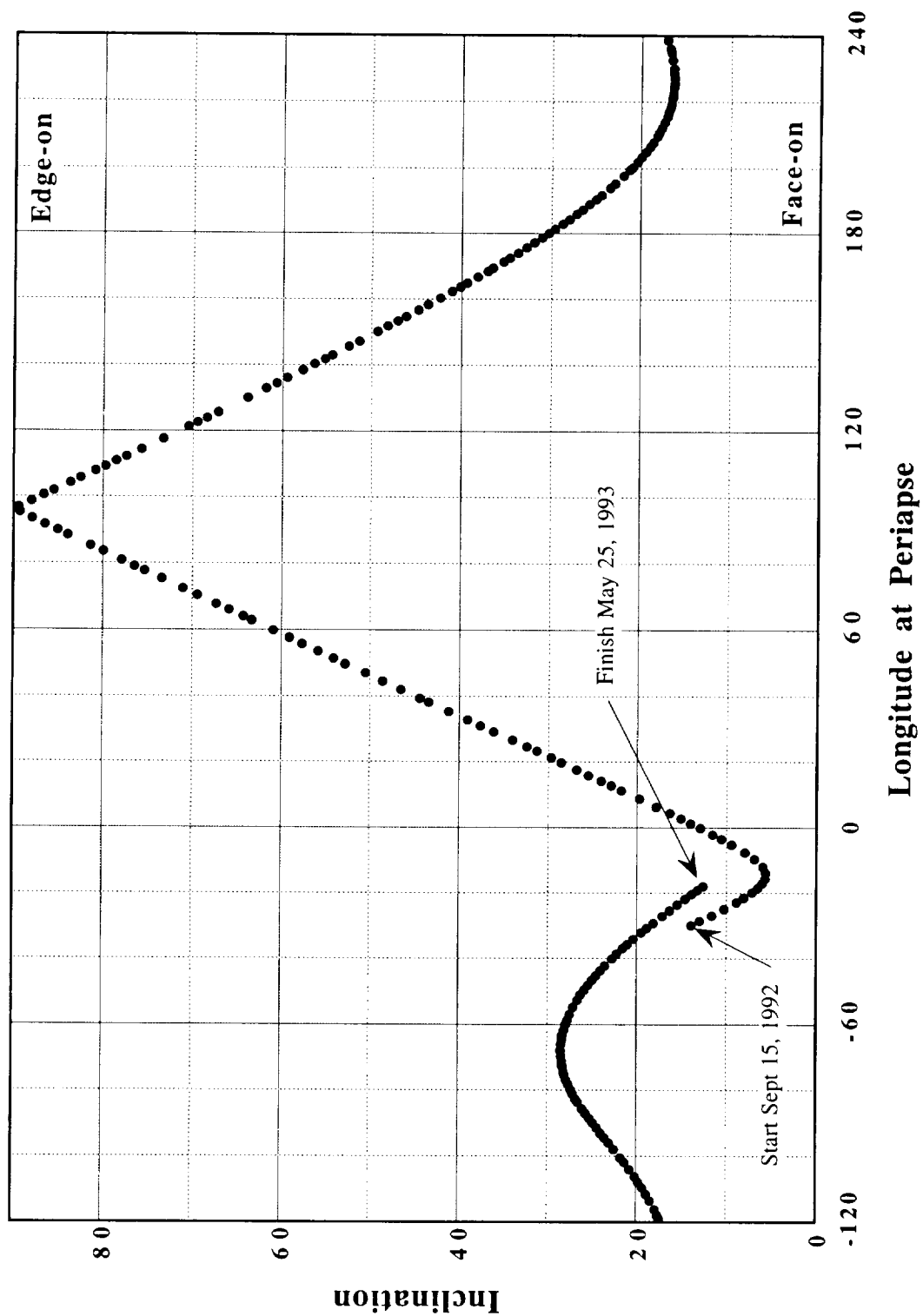
# Magellan Cycle 4 Altitude at Periapse



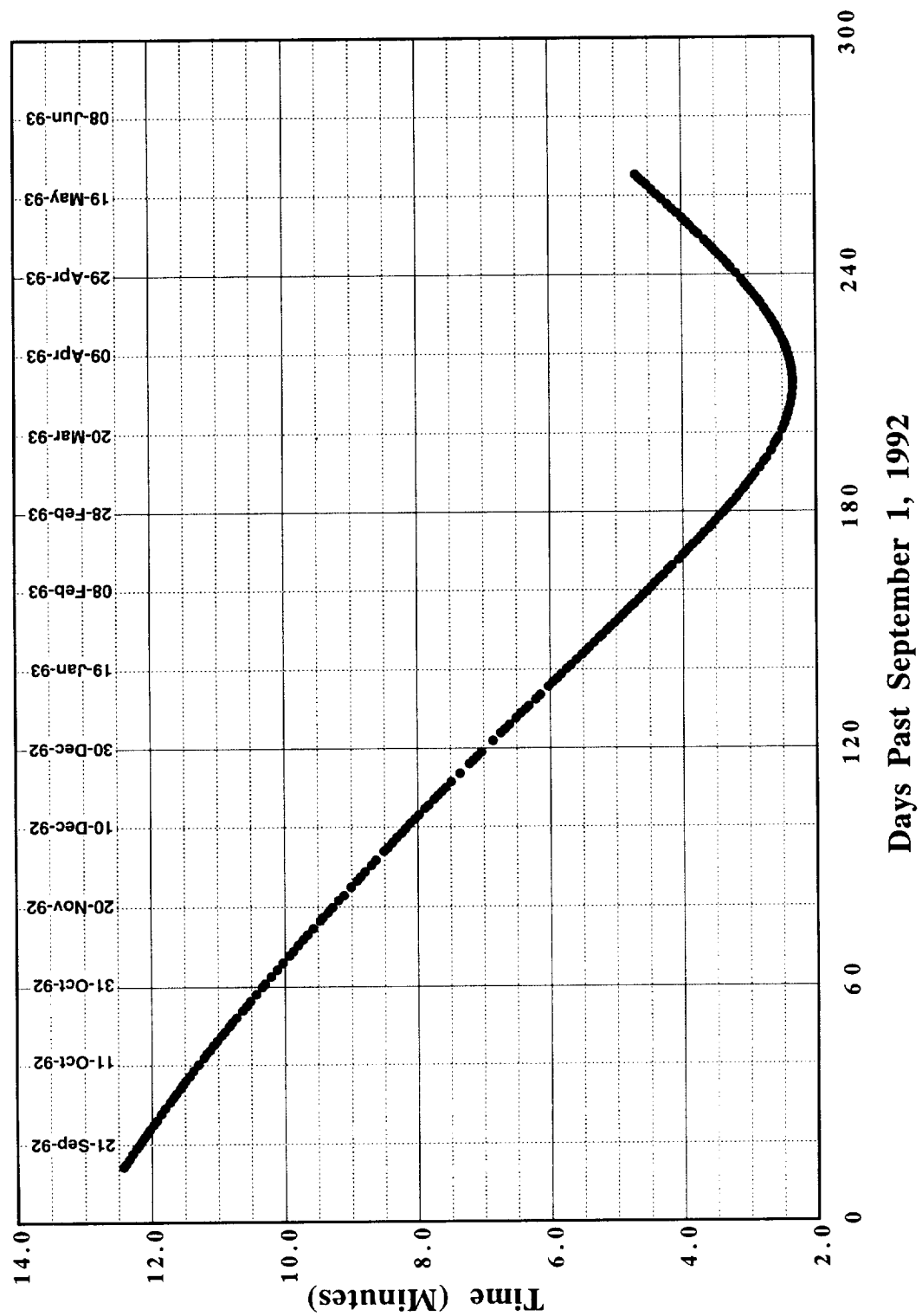
# Magellan Cycle 4 Plane-of-Sky Inclination



# Magellan Cycle 4 Plane-of-Sky Inclination

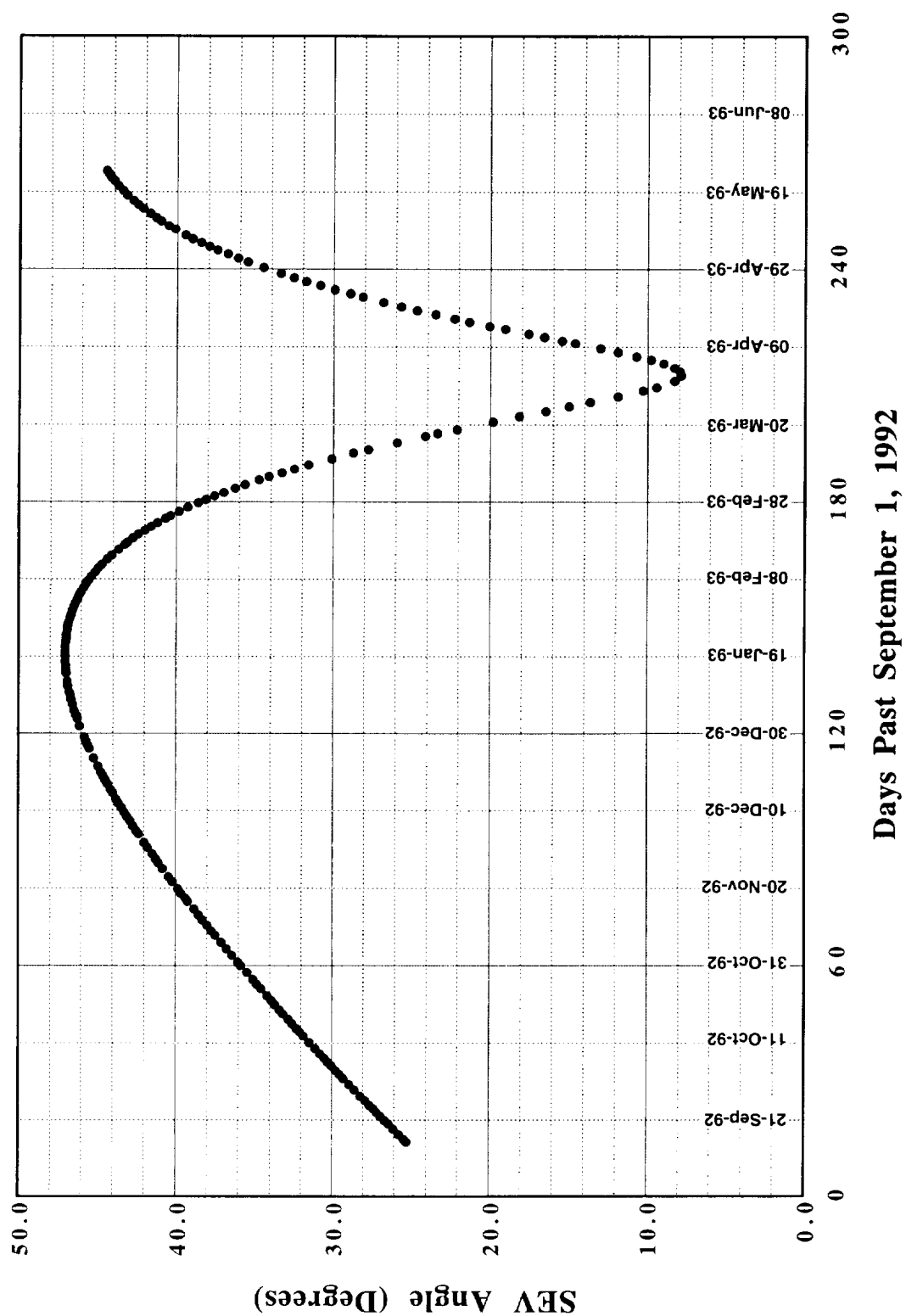


# Magellan Cycle 4 One-Way-Light-Time

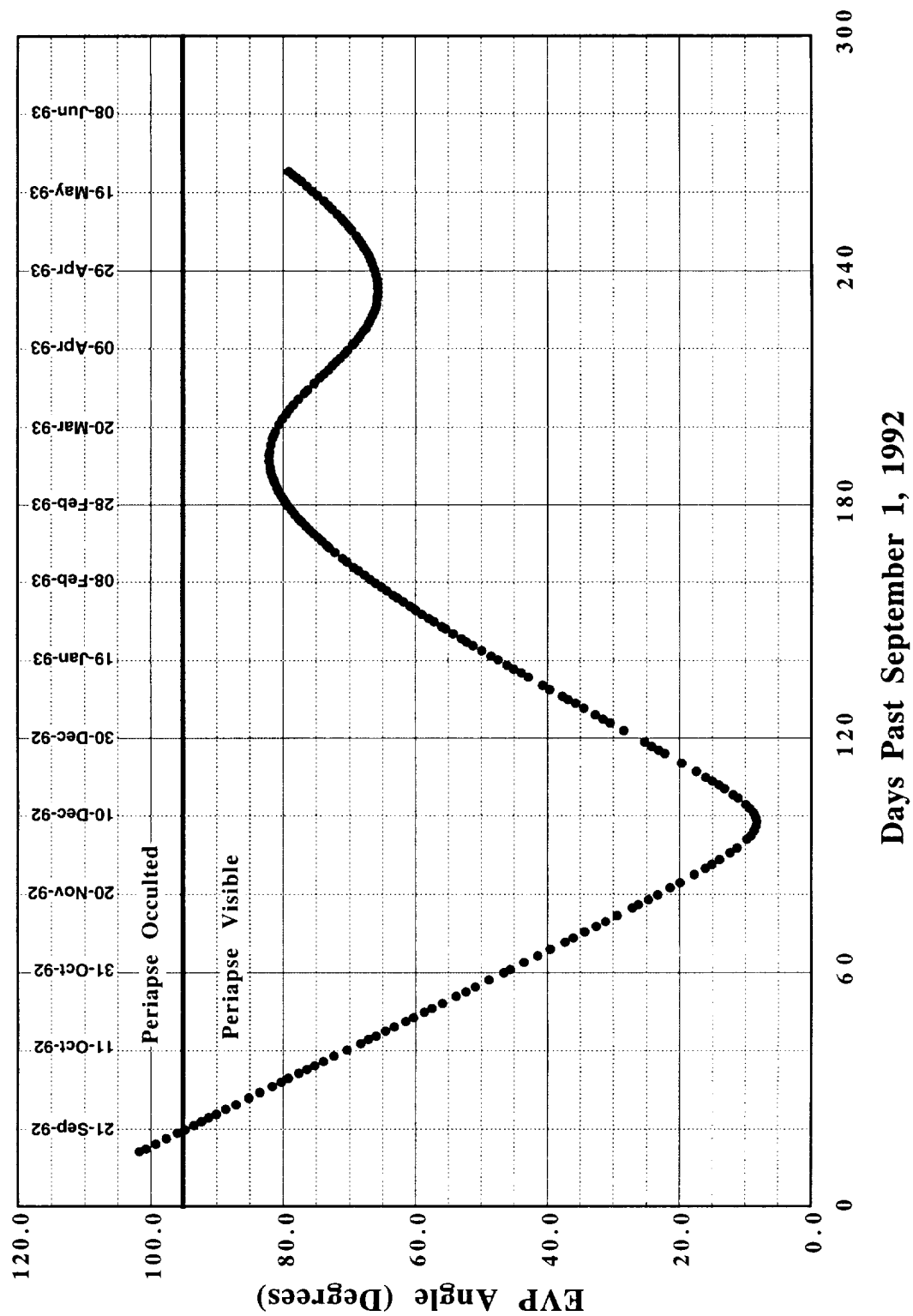




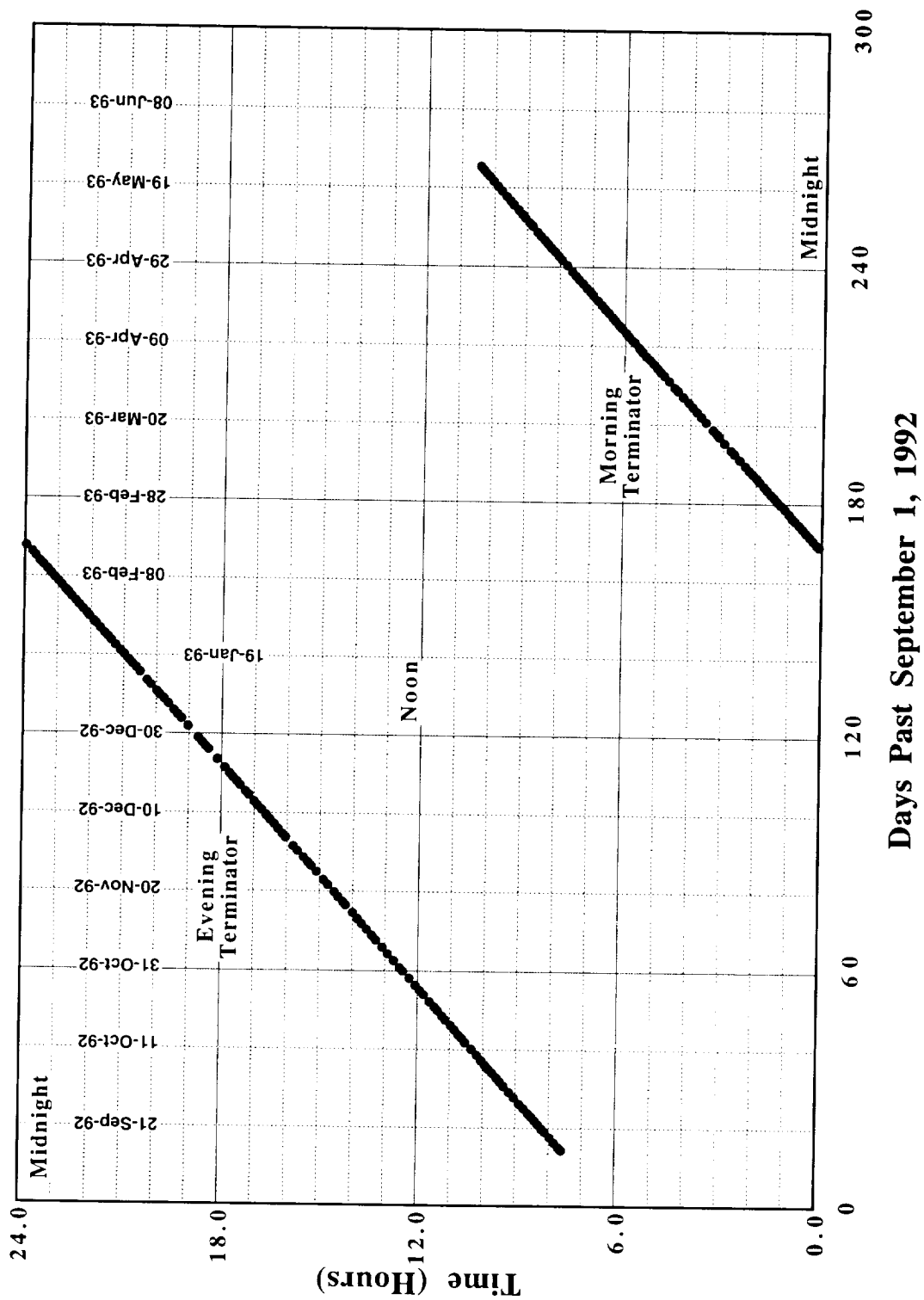
# Magellan Cycle 4 Sun-Earth-Venus Angle



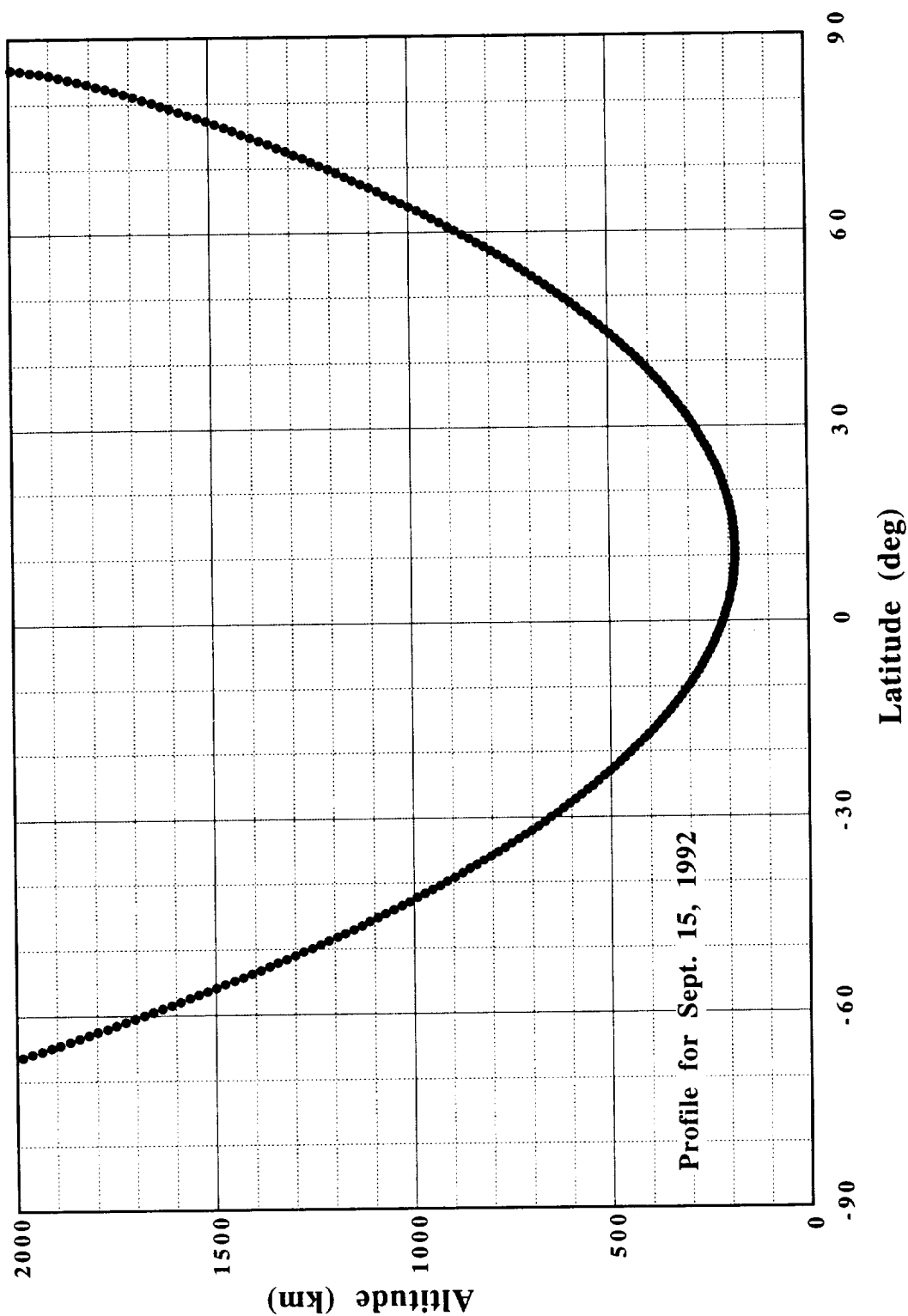
# Magellan Cycle 4 Earth-Venus-Probe at Periapse Angle



# Magellan Cycle 4 Local Solar Time at Periapse



# Magellan Cycle 4 Altitude vs Latitude



Profile for Sept. 15, 1992

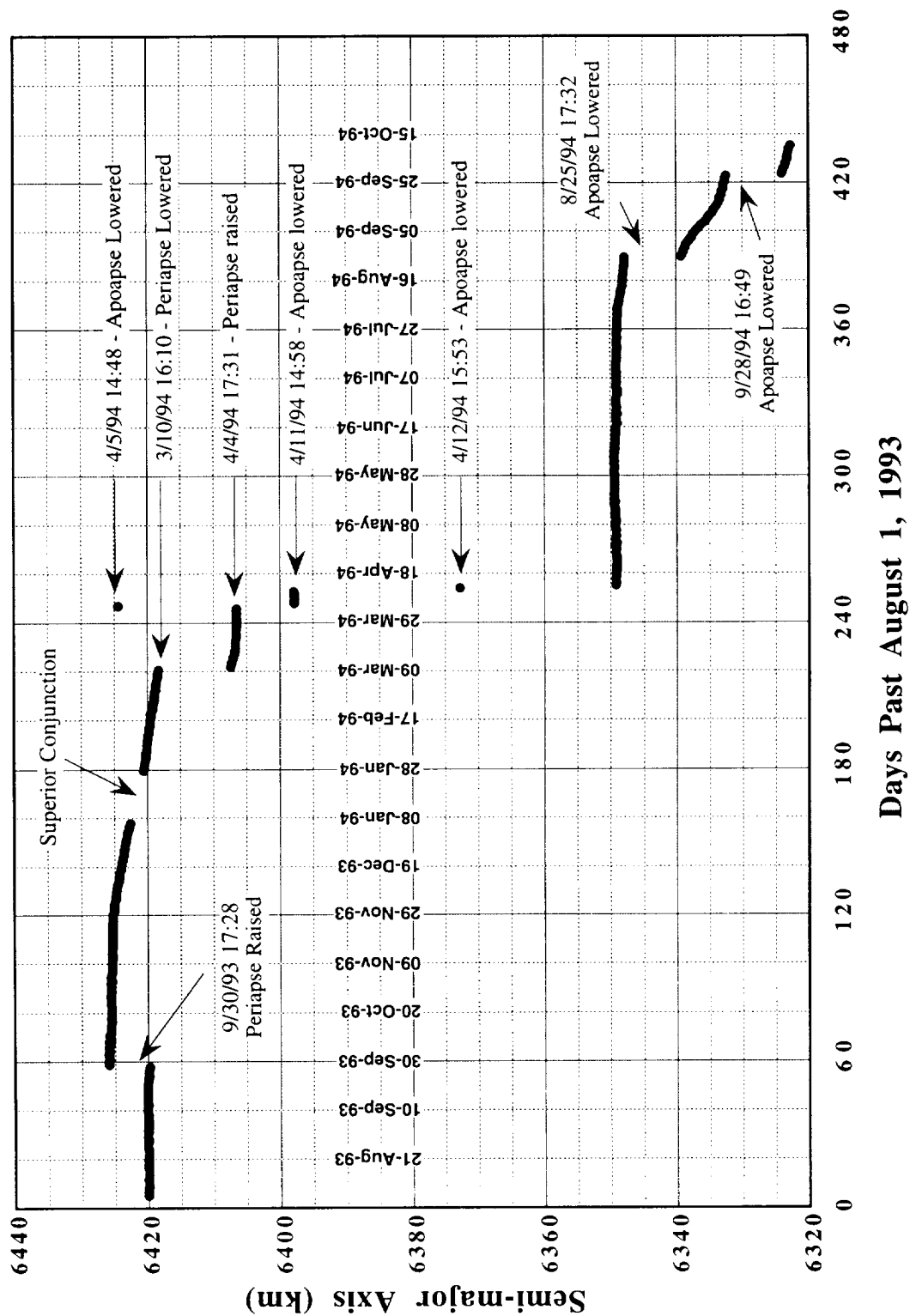
## **Appendix D**

### **Magellan Cycle 5 and 6 (Circular) Information**

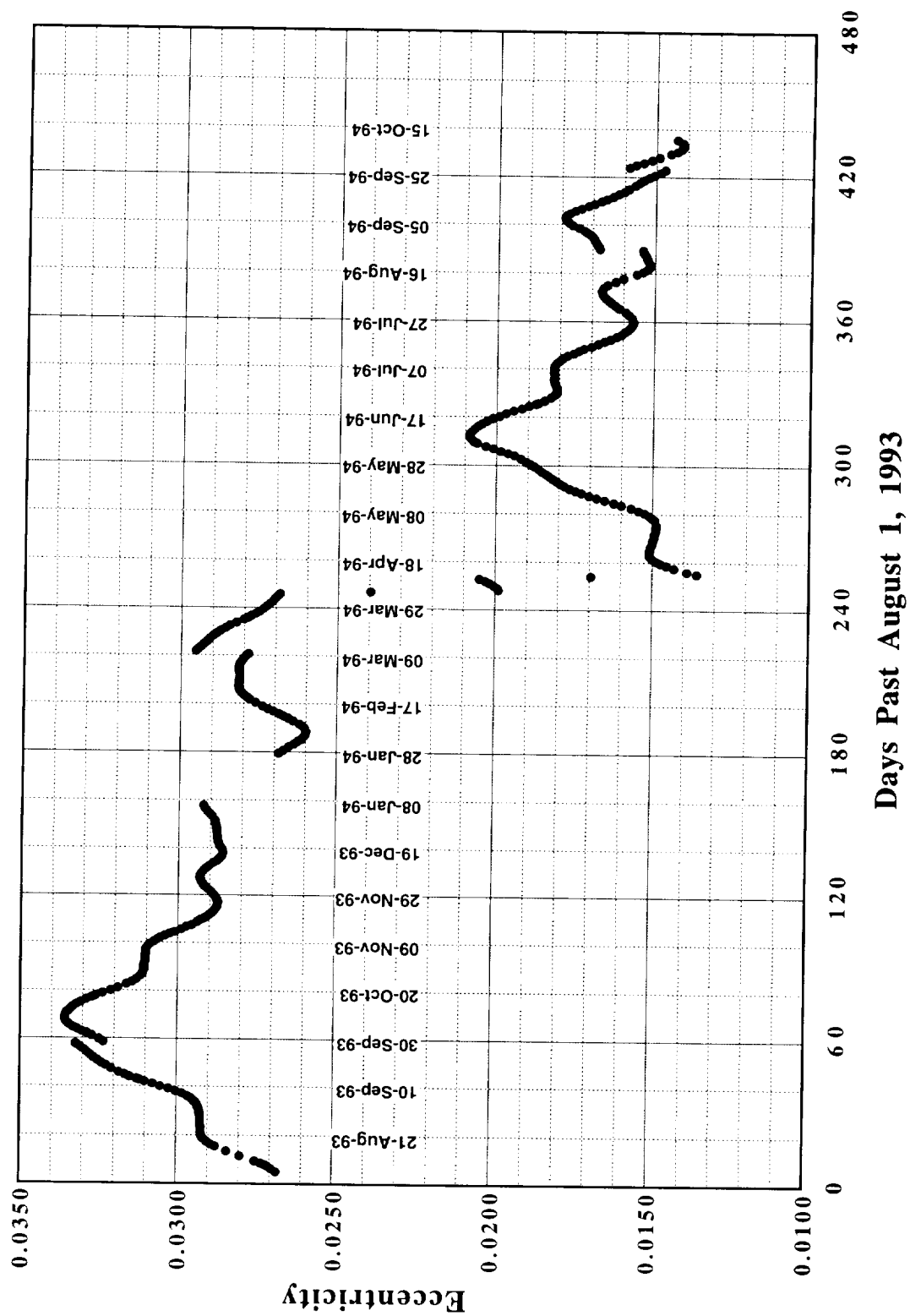
The following plots are included in this appendix:

1. Semi-major axis
2. Eccentricity
3. Inclination
4. Latitude at periapse
5. Longitude at periapse
6. Altitude at periapse
7. Altitude at apoapse
8. Plane-of-sky inclination vs time
9. Plane-of-sky inclination vs longitude
10. One-way light time from Venus to Earth
11. Sun-Earth-Venus angle
12. Earth-Venus-Probe at periapse angle
13. Local solar time at periapse
14. Altitude vs. latitude profile

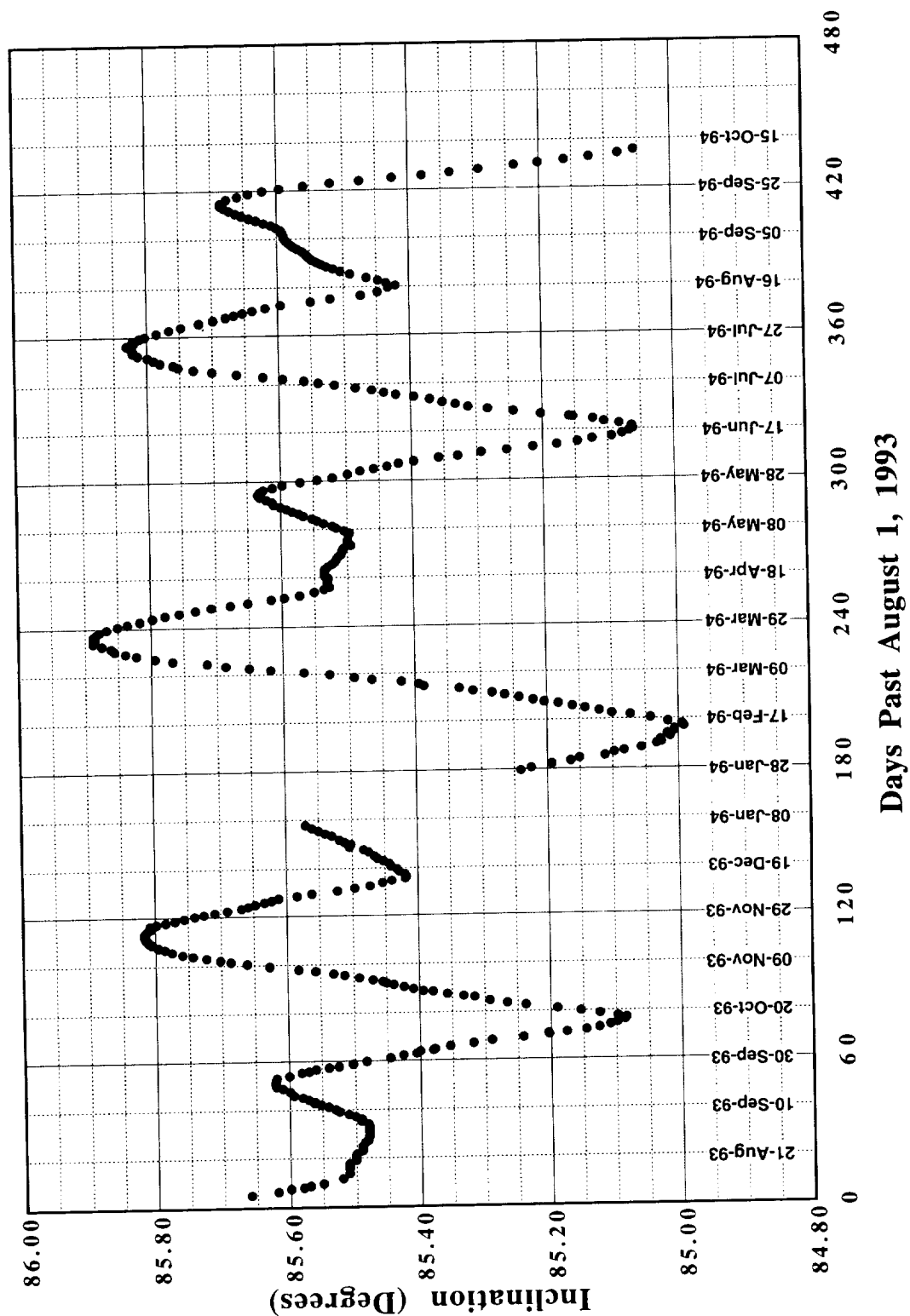
# Magellan Cycle 5&6 Semi-Major Axis



# Magellan Cycle 5&6 Eccentricity

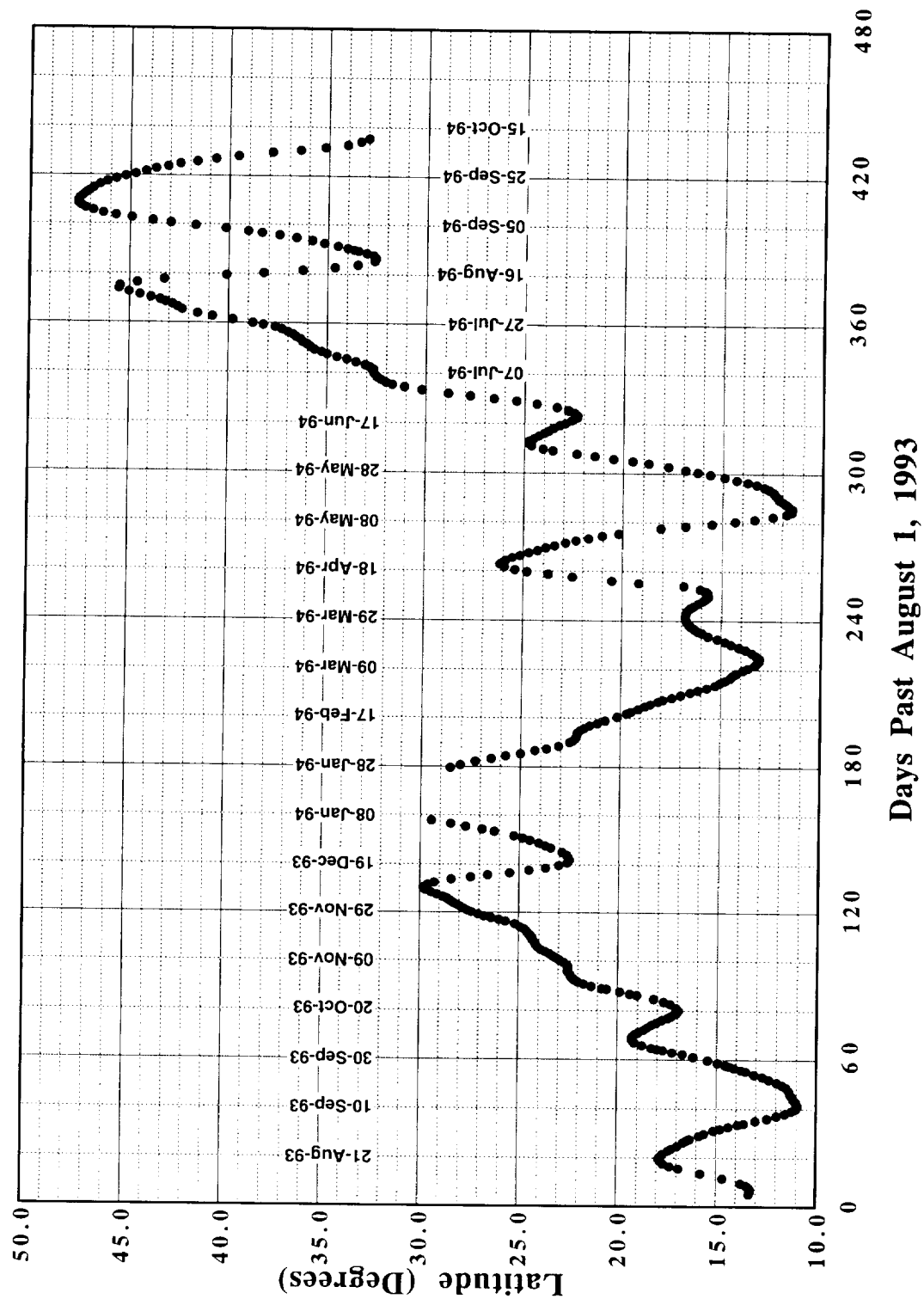


# Magellan Cycle 5&6 Inclination

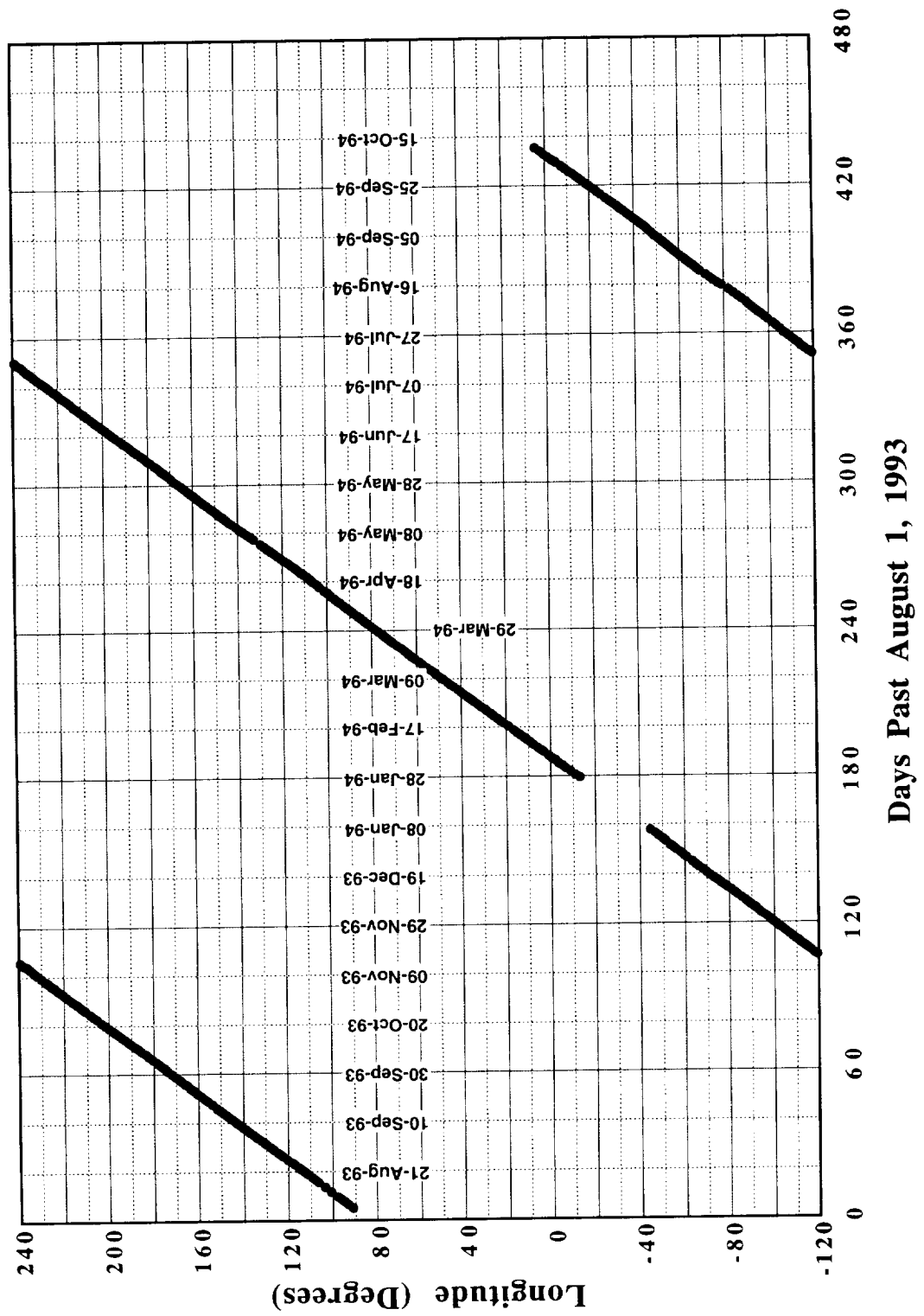




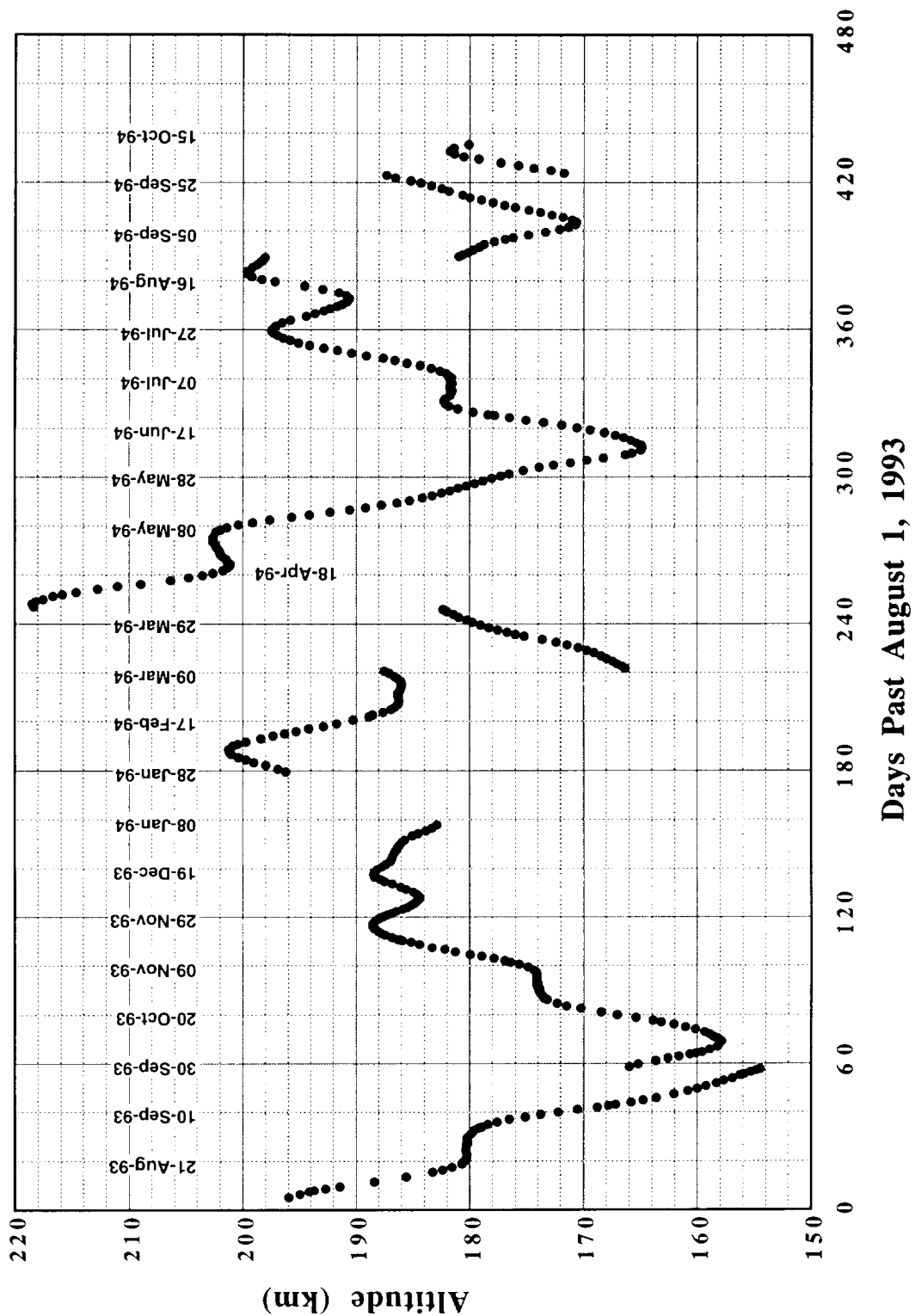
# Magellan Cycle 5&6 Latitude at Periapse



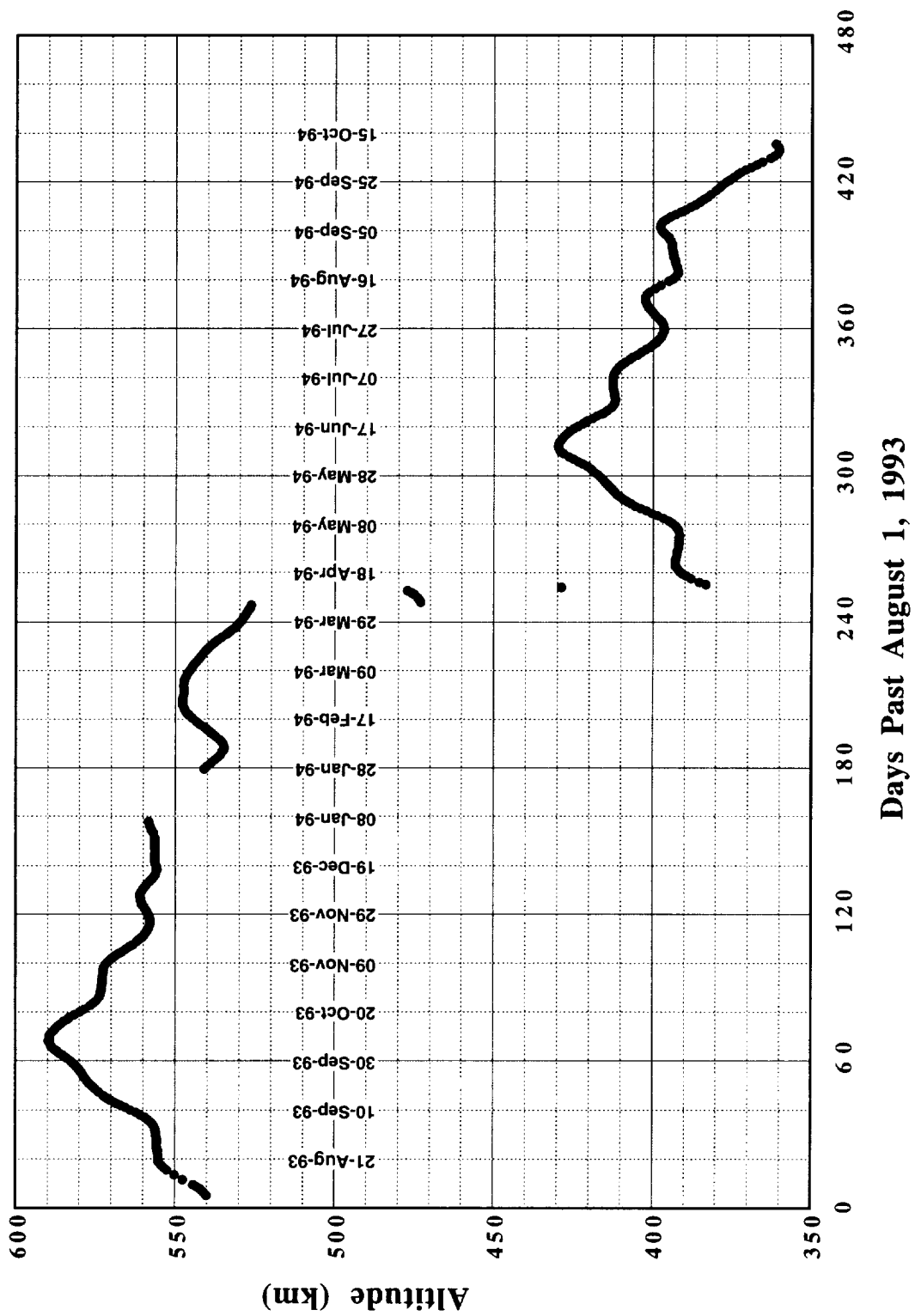
# Magellan Cycle 5&6 Longitude at Periapse



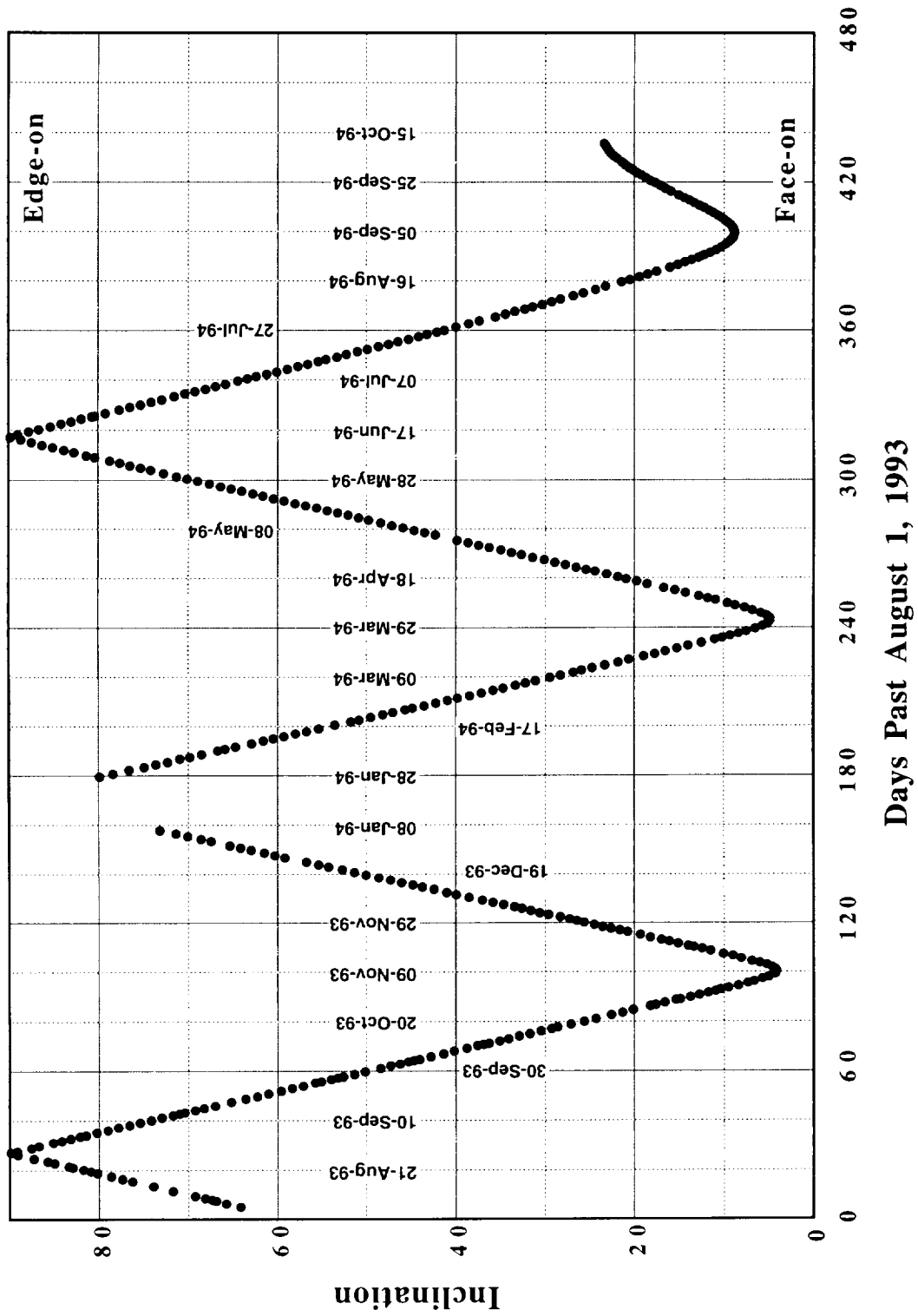
# Magellan Cycle 5&6 Altitude at Periapse



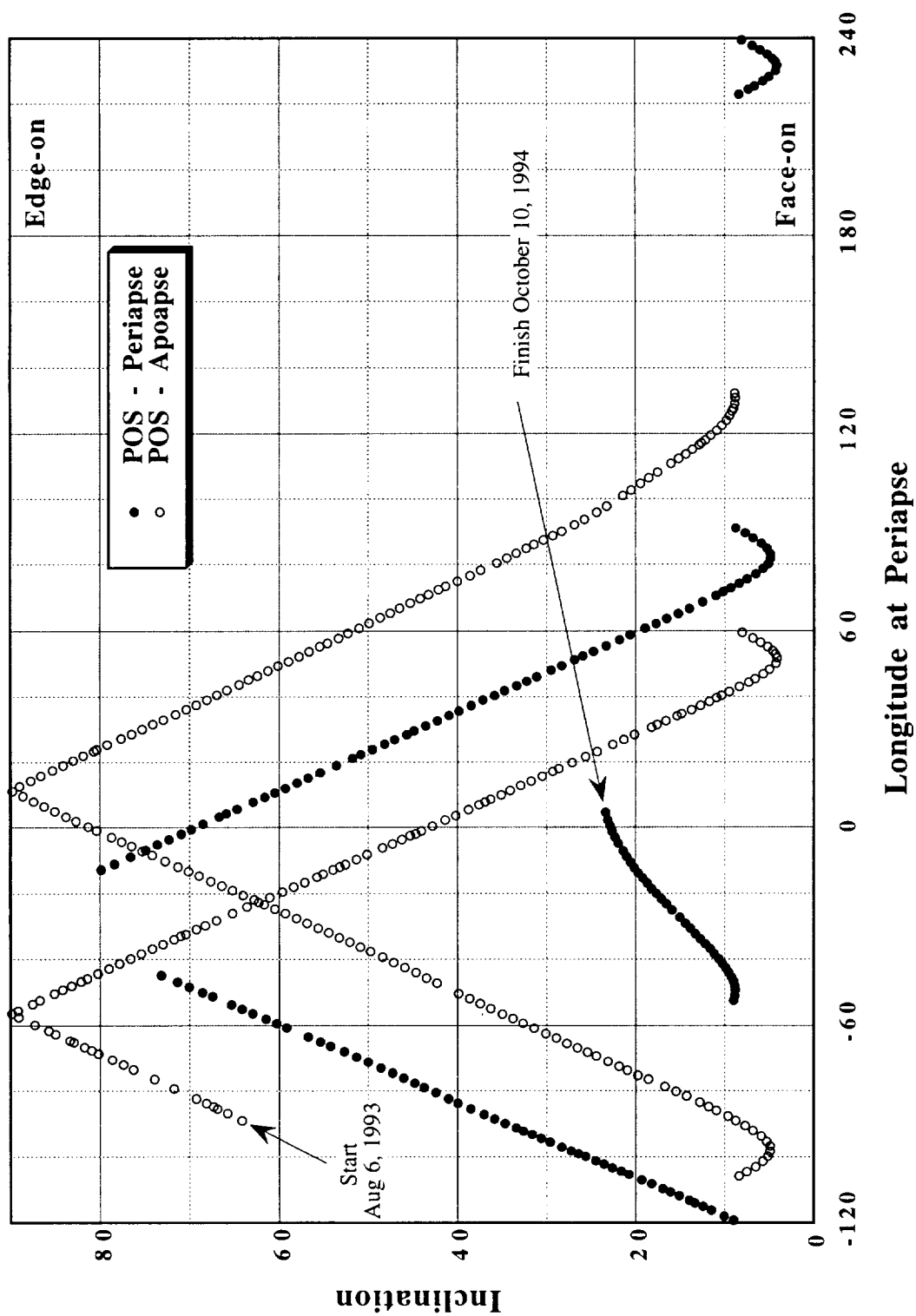
# Magellan Cycle 5&6 Altitude at Apoapse



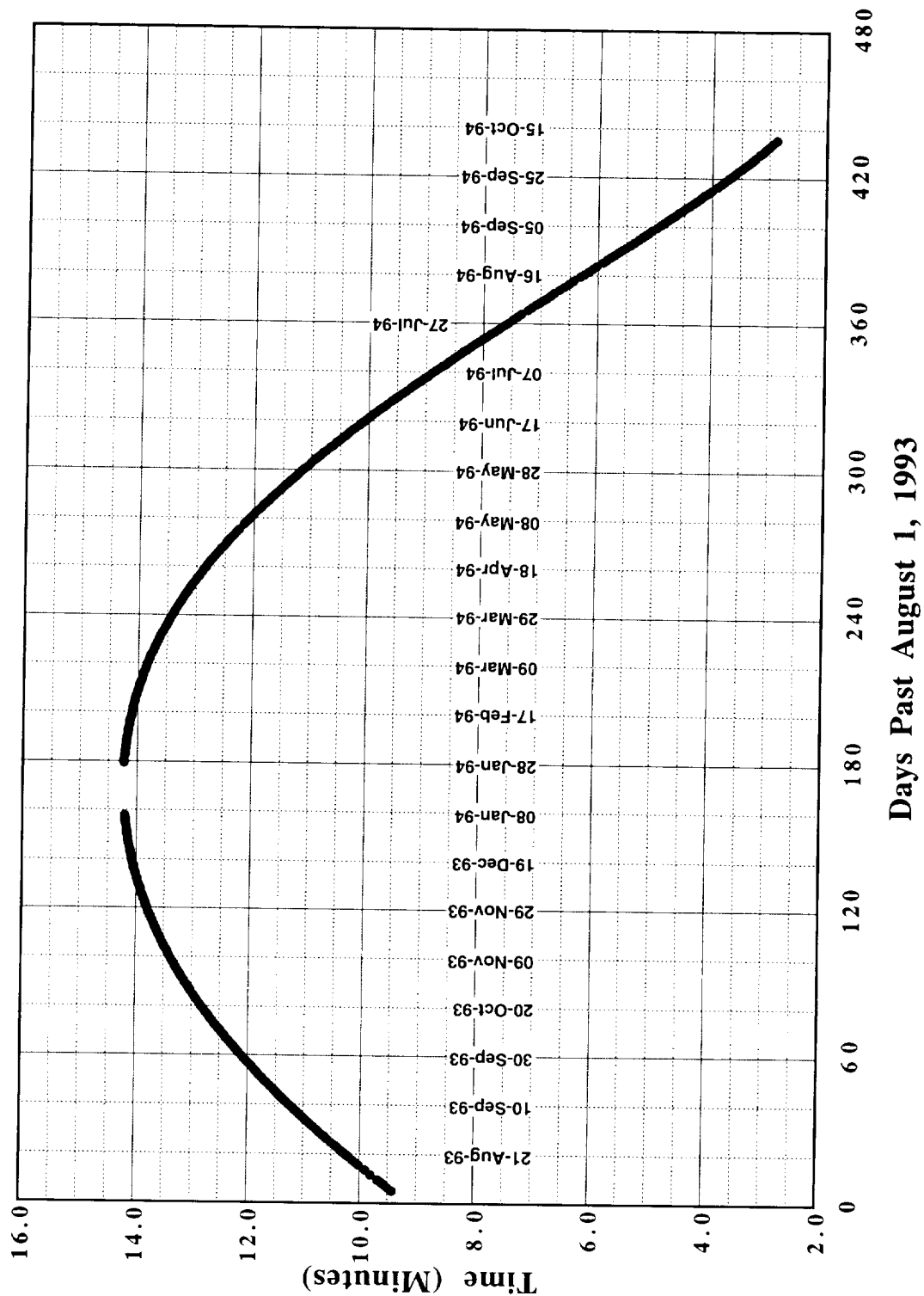
# Magellan Cycle 5&6 Plane-of-Sky Inclination



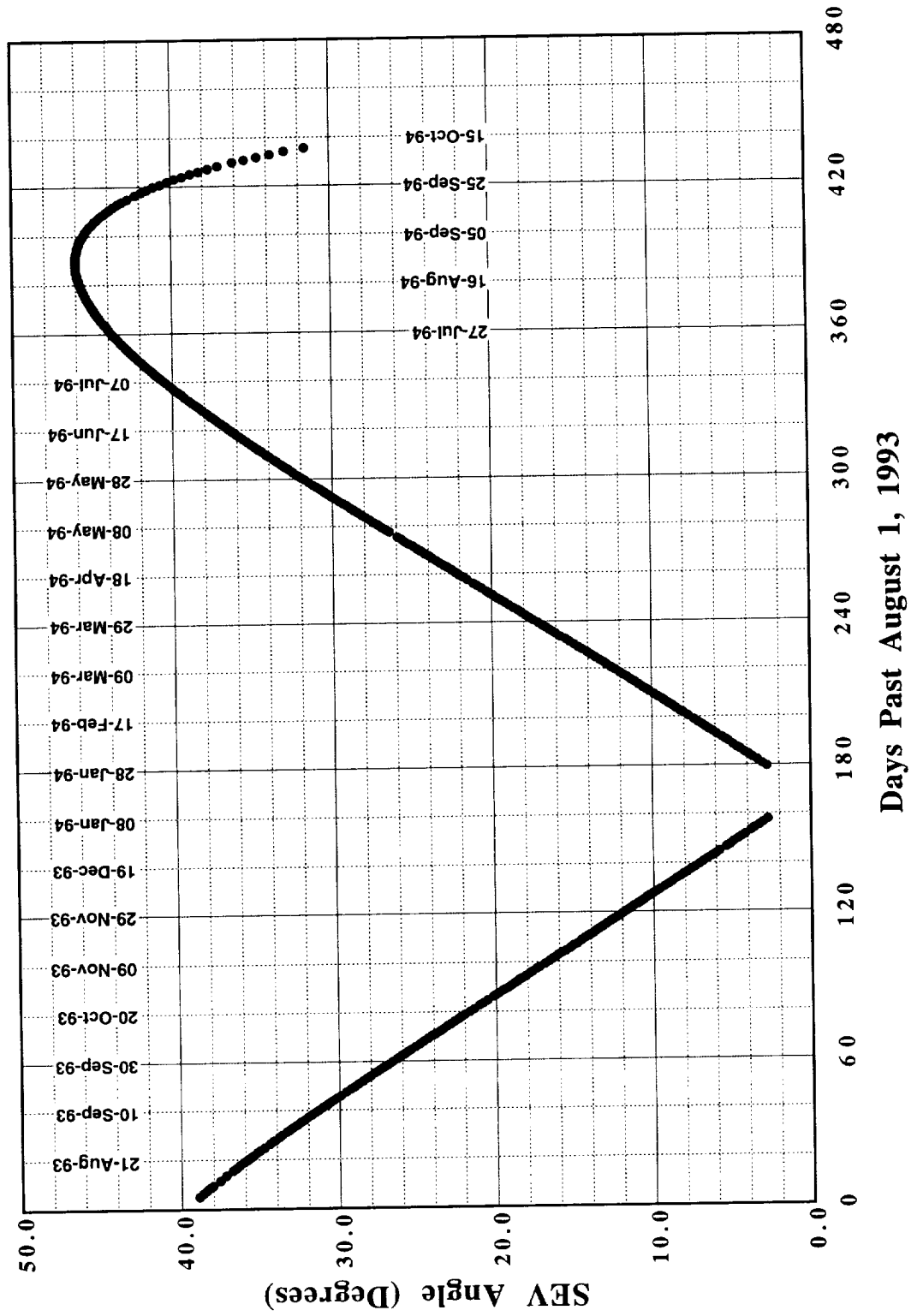
# Magellan Cycle 5&6 Plane-of-Sky Inclination



# Magellan Cycle 5&6 One-Way-Light-Time

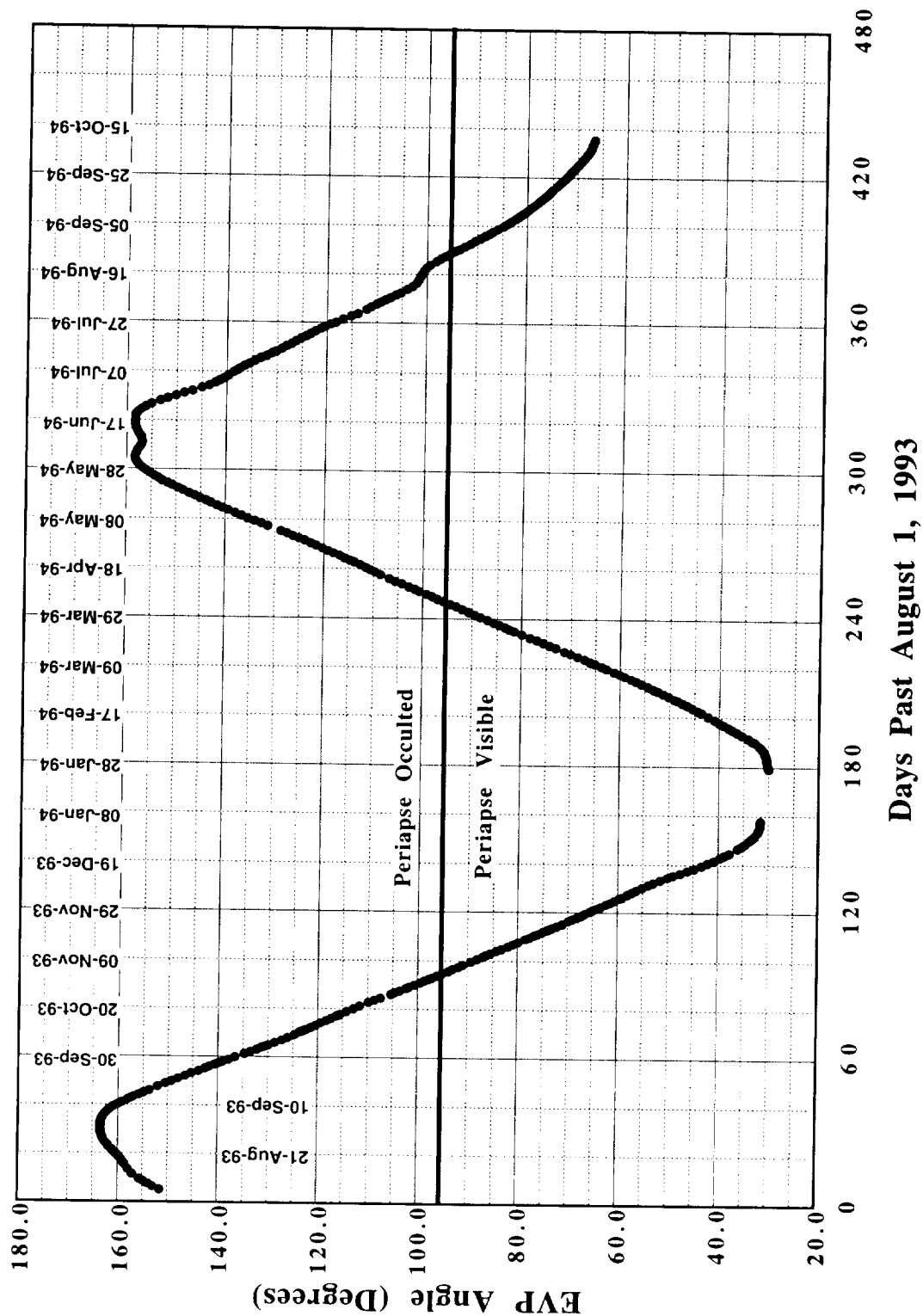


# Magellan Cycle 5&6 Sun-Earth-Venus Angle

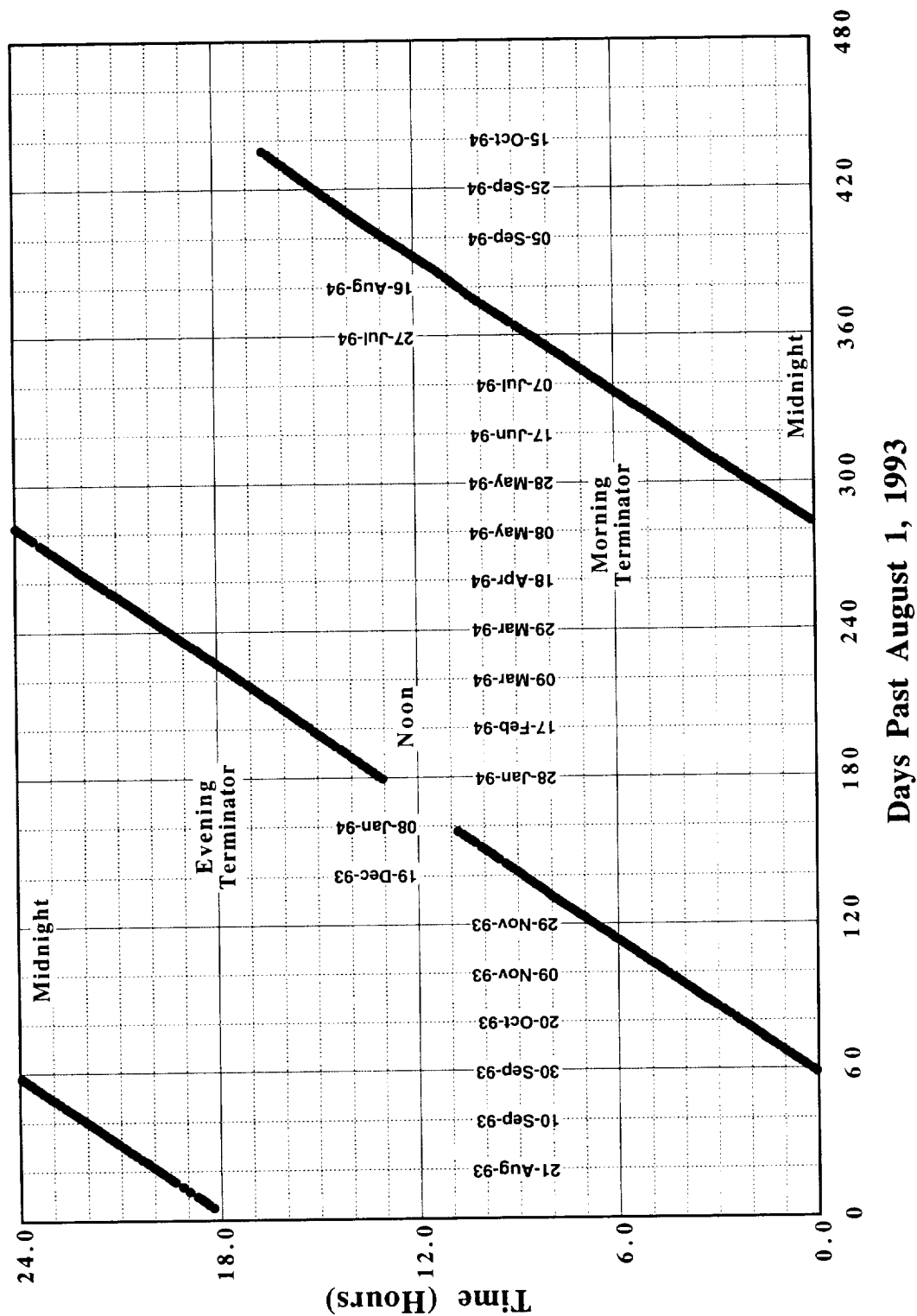




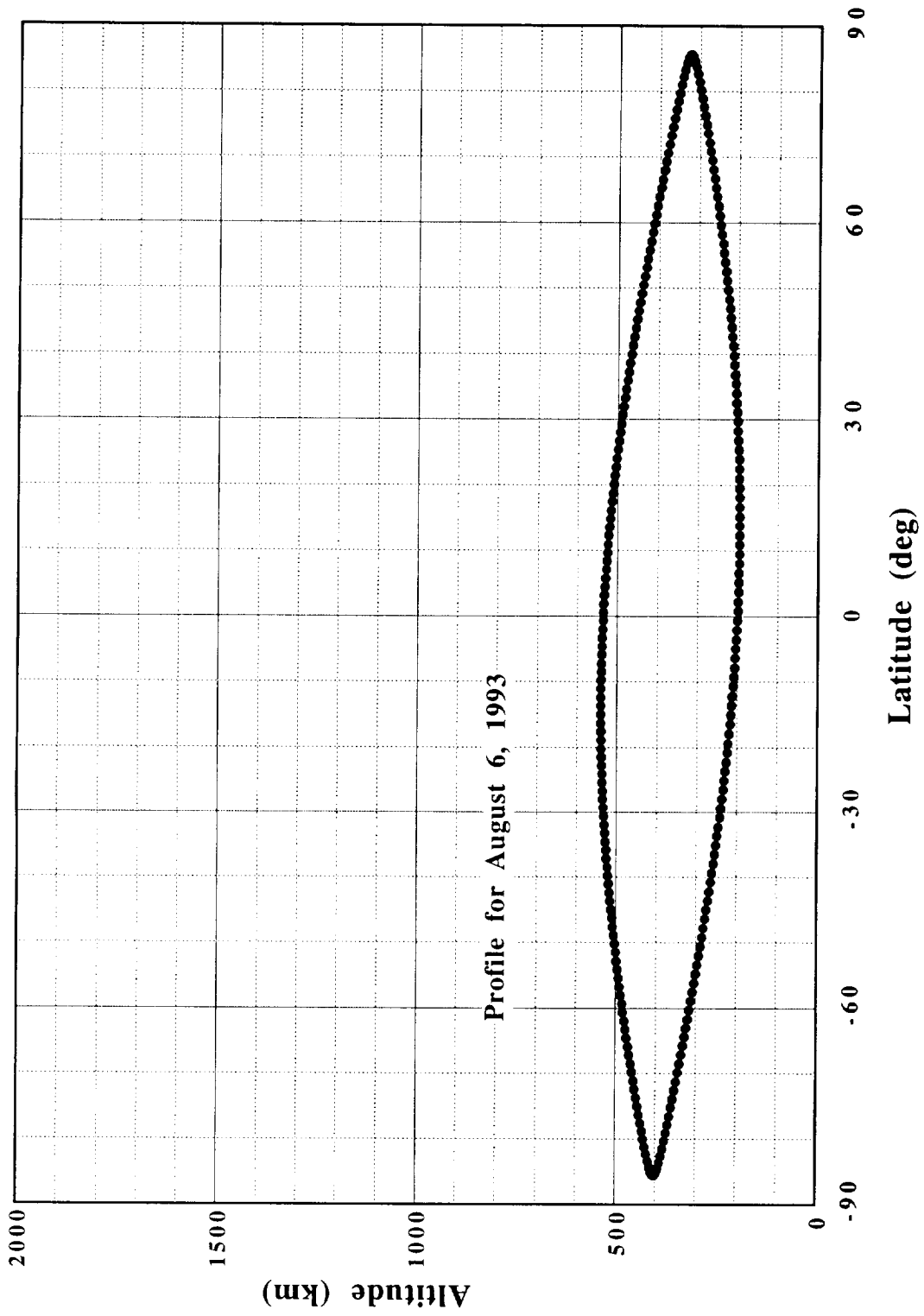
# Magellan Cycle 5&6 Earth-Venus-Probe at Periapse Angle



# Magellan Cycle 5&6 Local Solar Time at Periapse



# Magellan Cycle 5&6 Altitude vs Latitude





# Appendix E

## Magellan X-band Orbit Information

The columns contain the following information (in order):

1. Orbit number
2. Tracking data file name ("\_2" is 2 second data and "\_10" is 10 second data)
3. Number of Doppler observations
4. Tracking station number (15=Goldstone, 45=Canberra, 65=Madrid)
5. Time of first observation

5757	92258j261_10	878	65	15-SEP-1992	12:35:35	5830	92265j272_2	2	45	25-SEP-1992	09:14:30	5904	92279j286_2	51	45	5-OCT-1992	09:42:15
5758	92258j261_10	756	65	15-SEP-1992	15:50:05	5831	92265j272_2	1906	65	25-SEP-1992	13:21:35	5904	92279j286_2	1701	65	5-OCT-1992	10:21:59
5760	92258j261_10	836	45	15-SEP-1992	22:59:45	5833	92265j272_2	686	15	25-SEP-1992	20:14:08	5905	92279j286_2	2294	65	5-OCT-1992	12:56:45
5761	92258j261_10	872	45	16-SEP-1992	01:31:35	5834	92265j272_2	802	15	25-SEP-1992	22:50:30	5906	92279j286_2	90	15	5-OCT-1992	17:43:19
5762	92258j261_10	852	45	16-SEP-1992	04:48:05	5835	92265j272_2	1240	45	26-SEP-1992	02:09:30	5906	92279j286_2	1975	65	5-OCT-1992	16:11:15
5763	92258j261_10	268	45	16-SEP-1992	08:02:35	5836	92265j272_2	834	45	26-SEP-1992	05:19:30	5907	92279j286_2	1892	15	5-OCT-1992	19:27:30
5764	92258j261_10	338	65	16-SEP-1992	13:20:55	5837	92265j272_2	188	45	26-SEP-1992	08:34:30	5908	92279j286_2	1973	15	5-OCT-1992	22:41:30
5765	92258j261_10	707	65	16-SEP-1992	14:31:35	5837	92265j272_2	72	65	26-SEP-1992	10:29:30	5909	92279j286_2	2309	45	6-OCT-1992	01:54:35
5767	92258j261_10	2	45	17-SEP-1992	00:05:45	5838	92265j272_2	848	65	26-SEP-1992	11:48:30	5910	92279j286_2	2309	45	6-OCT-1992	05:09:05
5768	92258j261_10	10	45	17-SEP-1992	03:20:30	5839	92265j272_2	843	65	26-SEP-1992	15:03:30	5911	92279j286_2	1957	45	6-OCT-1992	08:23:35
5769	92258j261_10	847	45	17-SEP-1992	03:30:30	5840	92265j272_2	1001	15	26-SEP-1992	18:17:30	5911	92279j286_2	83	65	6-OCT-1992	10:24:35
5770	92258j261_10	740	45	17-SEP-1992	06:44:05	5841	92265j272_2	858	15	26-SEP-1992	21:32:30	5912	92279j286_2	2269	65	6-OCT-1992	11:38:05
5770	92258j261_10	2	65	17-SEP-1992	09:47:15	5842	92265j272_2	87	45	27-SEP-1992	02:25:30	5913	92279j286_2	2301	65	6-OCT-1992	14:52:35
5771	92261j262_10	830	65	17-SEP-1992	10:02:55	5843	92265j272_2	842	45	27-SEP-1992	04:01:30	5914	92279j286_2	50	65	6-OCT-1992	18:07:05
5772	92261j262_10	34	65	17-SEP-1992	13:13:05	5844	92265j272_2	770	45	27-SEP-1992	07:15:30	5916	92279j286_2	938	45	7-OCT-1992	01:40:55
5778	92261j262_10	59	65	18-SEP-1992	11:44:45	5845	92265j272_2	935	65	27-SEP-1992	10:32:47	5917	92279j286_2	2381	45	7-OCT-1992	03:50:25
5779	92262j266_2	872	65	18-SEP-1992	11:54:35	5846	92265j272_2	840	65	27-SEP-1992	13:44:30	5918	92279j286_2	2302	45	7-OCT-1992	07:04:55
5780	92262j266_2	36	65	18-SEP-1992	15:09:05	5847	92265j272_2	814	15	27-SEP-1992	17:24:30	5921	92279j286_2	1016	15	7-OCT-1992	17:58:27
5782	92262j266_2	60	45	19-SEP-1992	00:42:35	5848	92265j272_2	840	15	27-SEP-1992	20:13:30	5922	92279j286_2	2276	15	7-OCT-1992	20:02:45
5783	92262j266_2	879	45	19-SEP-1992	00:52:35	5849	92265j272_2	70	15	27-SEP-1992	23:27:30	5923	92279j286_2	2276	15	7-OCT-1992	23:17:15
5784	92262j266_2	288	45	19-SEP-1992	04:07:05	5851	92265j272_2	816	45	28-SEP-1992	06:20:30	5923	92279j286_2	35	45	8-OCT-1992	01:46:15
5785	92262j266_2	474	45	19-SEP-1992	07:21:35	5852	92272j279_2	7	45	28-SEP-1992	09:11:30	5924	92279j286_2	2294	45	8-OCT-1992	02:31:45
5785	92262j266_2	236	65	19-SEP-1992	09:43:45	5855	92272j279_2	997	15	28-SEP-1992	17:32:30	5925	92279j286_2	2301	45	8-OCT-1992	05:46:15
5786	92262j266_2	879	65	19-SEP-1992	10:36:05	5856	92272j279_2	816	15	28-SEP-1992	22:09:30	5926	92279j286_2	1063	45	8-OCT-1992	09:00:45
5787	92262j266_2	846	65	19-SEP-1992	13:50:35	5857	92272j279_2	21	15	29-SEP-1992	01:23:30	5926	92279j286_2	333	65	8-OCT-1992	10:30:15
5789	92262j266_2	570	15	19-SEP-1992	21:00:35	5859	92272j279_2	3	65	29-SEP-1992	10:22:30	5927	92279j286_2	2303	65	8-OCT-1992	12:15:05
5789	92262j266_2	261	45	19-SEP-1992	22:37:05	5860	92272j279_2	842	65	29-SEP-1992	11:07:30	5928	92279j286_2	2306	65	8-OCT-1992	15:29:35
5790	92262j266_2	866	45	19-SEP-1992	23:34:05	5861	92272j279_2	761	65	29-SEP-1992	14:21:30	5929	92279j286_2	2300	15	8-OCT-1992	18:44:05
5791	92262j266_2	866	45	20-SEP-1992	02:48:35	5862	92272j279_2	148	65	29-SEP-1992	17:36:30	5930	92279j286_2	974	15	8-OCT-1992	21:58:35
5792	92262j266_2	862	45	20-SEP-1992	06:03:05	5864	92272j279_2	9	45	30-SEP-1992	02:13:30	5934	92279j286_2	2304	65	9-OCT-1992	10:56:25
5793	92262j266_2	837	65	20-SEP-1992	09:58:35	5865	92272j279_2	824	45	30-SEP-1992	03:19:30	5935	92279j286_2	2305	65	9-OCT-1992	14:10:55
5794	92262j266_2	874	65	20-SEP-1992	12:32:05	5866	92272j279_2	914	45	30-SEP-1992	06:33:30	5936	92279j286_2	1964	15	9-OCT-1992	17:56:07
5795	92262j266_2	613	15	20-SEP-1992	17:06:05	5868	92272j279_2	804	65	30-SEP-1992	13:15:30	5936	92279j286_2	255	65	9-OCT-1992	17:25:25
5795	92262j266_2	265	65	20-SEP-1992	15:46:35	5869	92272j279_2	352	15	30-SEP-1992	17:36:01	5937	92279j286_2	2181	15	9-OCT-1992	20:02:55
5796	92262j266_2	881	15	20-SEP-1992	19:01:05	5870	92272j279_2	1907	15	30-SEP-1992	19:31:30	5938	92279j286_2	34	15	9-OCT-1992	23:17:25
5797	92262j266_2	37	15	20-SEP-1992	22:15:35	5871	92272j279_2	1823	15	30-SEP-1992	22:46:30	5938	92279j286_2	342	45	10-OCT-1992	01:24:05
5797	92262j266_2	775	45	20-SEP-1992	22:56:35	5872	92272j279_2	1894	45	1-OCT-1992	02:10:30	5939	92279j286_2	2162	45	10-OCT-1992	02:31:45
5799	92262j266_2	2068	45	21-SEP-1992	05:44:45	5873	92272j279_2	1899	45	1-OCT-1992	05:15:30	5940	92279j286_2	2192	45	10-OCT-1992	05:46:15
5800	92262j266_2	495	45	21-SEP-1992	07:59:05	5874	92272j279_2	1189	45	1-OCT-1992	08:29:30	5941	92279j286_2	41	45	10-OCT-1992	09:00:45
5800	92262j266_2	863	65	21-SEP-1992	09:48:09	5877	92272j279_2	2277	15	1-OCT-1992	18:27:21	5941	92279j286_2	1141	65	10-OCT-1992	10:35:27
5801	92262j266_2	1858	65	21-SEP-1992	11:13:35	5878	92272j279_2	2299	15	1-OCT-1992	21:27:30	5942	92279j286_2	2194	65	10-OCT-1992	12:15:15
5802	92262j266_2	1771	65	21-SEP-1992	14:28:05	5879	92272j279_2	1389	15	2-OCT-1992	01:04:05	5943	92279j286_2	5	65	10-OCT-1992	15:29:45
5804	92262j266_2	937	45	21-SEP-1992	22:39:23	5879	92272j279_2	540	45	2-OCT-1992	02:02:57	5946	92279j286_2	2154	45	11-OCT-1992	02:14:15
5805	92262j266_2	1603	45	22-SEP-1992	00:12:30	5880	92272j279_2	2300	45	2-OCT-1992	03:54:45	5947	92279j286_2	2169	45	11-OCT-1992	04:27:35
5806	92262j266_2	1907	45	22-SEP-1992	03:26:30	5881	92272j279_2	2267	45	2-OCT-1992	07:09:15	5948	92279j286_2	1742	45	11-OCT-1992	07:42:05
5807	92262j266_2	1856	45	22-SEP-1992	06:41:30	5882	92272j279_2	2304	65	2-OCT-1992	10:23:45	5948	92279j286_2	100	65	11-OCT-1992	10:39:55
5811	92265j272_2	1927	15	22-SEP-1992	20:26:30	5883	92272j279_2	2219	65	2-OCT-1992	13:38:15	5949	92279j286_2	2188	65	11-OCT-1992	10:56:35
5812	92265j272_2	1876	15	22-SEP-1992	22:53:30	5884	92272j279_2	1750	15	2-OCT-1992	17:31:43	5950	92279j286_2	453	65	11-OCT-1992	14:10:55
5815	92265j272_2	1644	65	23-SEP-1992	09:52:23	5885	92272j279_2	2108	15	2-OCT-1992	20:07:15	5951	92279j286_2	2132	15	11-OCT-1992	18:26:31
5816	92265j272_2	1936	65	23-SEP-1992	11:51:30	5886	92272j279_2	12	45	3-OCT-1992	01:54:35	5952	92279j286_2	2187	15	11-OCT-1992	20:39:55
5817	92265j272_2	78	15	23-SEP-1992	17:18:30	5887	92272j279_2	2296	45	3-OCT-1992	02:36:15	5953	92279j286_2	554	15	11-OCT-1992	23:54:25
5817	92265j272_2	1005	65	23-SEP-1992	15:06:30	5888	92272j279_2	2310	45	3-OCT-1992	05:50:45	5953	92279j286_2	1607	45	12-OCT-1992	01:13:27
5818	92265j272_2	1630	15	23-SEP-1992	18:20:30	5889	92272j279_2	449	45	3-OCT-1992	09:05:15	5954	92279j286_2	2183	45	12-OCT-1992	03:08:55
5819	92265j272_2	1661	15	23-SEP-1992	21:35:30	5889	92272j279_2	764	65	3-OCT-1992	10:16:41	5955	92279j293_2	2170	45	12-OCT-1992	06:23:15
5820	92265j272_2	6	15	24-SEP-1992	00:49:30	5890	92272j279_2	2297	65	3-OCT-1992	12:19:35	5956	92286j293_2	40	45	12-OCT-1992	09:37:45
5820	92265j272_2	581	45	24-SEP-1992	02:38:37	5891	92272j279_2	62	15	3-OCT-1992	17:44:35	5956	92286j293_2	2077	65	12-OCT-1992	10:40:53
5821	92265j272_2	1939	45	24-SEP-1992	04:04:30	5891	92272j279_2	127	65	3-OCT-1992	15:34:05	5957	92286j293_2	1934	65	12-OCT-1992	12:52:15
5822	92265j272_2	1568	45	24-SEP-1992	07:18:30	5892	92272j279_2	2300	15	3-OCT-1992	18:48:35	5958	92286j293_2	468	15	12-OCT-1992	18:03:37
5822	92265j272_2	18	65	24-SEP-1992	10:00:30	5893	92272j279_2	1923	15	3-OCT-1992	22:03:05	5959	92286j293_2	2174			

5967	92286j293_2	877	15	13-OCT-1992	21:16:55	6093	92300j307_2	2054	45	30-OCT-1992	22:38:15	6254	92321j328_2	1825	65	21-NOV-1992	16:20:45
5970	92286j293_2	1899	45	14-OCT-1992	08:01:17	6094	92300j307_2	2198	45	31-OCT-1992	01:04:45	6256	92321j328_2	1835	45	21-NOV-1992	22:49:25
5971	92286j293_2	1885	65	14-OCT-1992	11:23:29	6095	92300j307_2	68	45	31-OCT-1992	04:19:15	6257	92321j328_2	1833	45	22-NOV-1992	02:03:45
5972	92286j293_2	1576	65	14-OCT-1992	13:29:15	6097	92300j307_2	2046	65	31-OCT-1992	11:35:55	6258	92321j328_2	1787	45	22-NOV-1992	05:18:05
5973	92286j293_2	1681	15	14-OCT-1992	17:59:45	6098	92300j307_2	2193	65	31-OCT-1992	14:02:35	6259	92321j328_2	1836	45	22-NOV-1992	08:32:35
5974	92286j293_2	2170	15	14-OCT-1992	19:58:05	6099	92300j307_2	1186	15	31-OCT-1992	18:37:47	6264	92321j328_2	1834	45	23-NOV-1992	00:44:25
5975	92286j293_2	39	15	14-OCT-1992	23:12:35	6099	92300j307_2	136	65	31-OCT-1992	17:16:55	6265	92321j335_2	1836	45	23-NOV-1992	03:58:45
5975	92286j293_2	100	45	15-OCT-1992	02:10:25	6100	92300j307_2	1866	15	31-OCT-1992	20:31:25	6268	92321j335_2	1825	65	23-NOV-1992	13:41:55
5976	92286j293_2	1838	45	15-OCT-1992	02:27:05	6101	92300j307_2	64	45	1-NOV-1992	01:31:23	6269	92321j335_2	1829	65	23-NOV-1992	16:56:15
5977	92286j293_2	1965	45	15-OCT-1992	05:41:35	6102	92300j307_2	2142	45	1-NOV-1992	03:00:15	6271	92328j335_2	1828	45	23-NOV-1992	23:24:55
5978	92286j293_2	39	45	15-OCT-1992	08:56:05	6104	92300j307_2	175	65	1-NOV-1992	11:32:15	6272	92328j335_2	1821	45	24-NOV-1992	02:39:25
5979	92286j293_2	2099	65	15-OCT-1992	13:11:25	6105	92300j307_2	1408	65	1-NOV-1992	12:43:25	6273	92328j335_2	1831	45	24-NOV-1992	05:53:45
5981	92286j293_2	101	15	15-OCT-1992	21:37:05	6112	92300j314_2	1866	65	2-NOV-1992	12:12:15	6274	92328j335_2	1828	45	24-NOV-1992	09:08:15
5982	92286j293_2	803	15	15-OCT-1992	21:53:55	6113	92300j314_2	1934	65	2-NOV-1992	14:38:55	6277	92328j335_2	1221	15	24-NOV-1992	19:12:45
5982	92286j293_2	59	45	16-OCT-1992	00:58:35	6116	92307j314_2	987	15	3-NOV-1992	00:22:05	6278	92328j335_2	550	45	24-NOV-1992	22:48:25
5983	92286j293_2	2134	45	16-OCT-1992	01:08:15	6124	92307j314_2	39	45	4-NOV-1992	04:16:35	6279	92328j335_2	1778	45	25-NOV-1992	01:19:55
5984	92286j293_2	2152	45	16-OCT-1992	04:22:45	6125	92307j314_2	1933	45	4-NOV-1992	05:31:55	6280	92328j335_2	1807	45	25-NOV-1992	04:34:25
5985	92286j293_2	1996	45	16-OCT-1992	07:37:15	6127	92307j314_2	30	65	4-NOV-1992	14:01:25	6283	92328j335_2	1830	65	25-NOV-1992	14:17:25
5986	92286j293_2	752	65	16-OCT-1992	12:38:05	6128	92307j314_2	1932	65	4-NOV-1992	15:15:05	6284	92328j335_2	1272	65	25-NOV-1992	17:31:35
5987	92286j293_2	92	65	16-OCT-1992	14:06:05	6130	92307j314_2	1886	45	4-NOV-1992	22:31:45	6286	92328j335_2	1819	45	26-NOV-1992	00:00:45
5990	92286j293_2	2032	45	17-OCT-1992	00:52:59	6131	92307j314_2	1937	45	5-NOV-1992	00:58:25	6287	92328j335_2	1832	45	26-NOV-1992	03:15:05
5991	92286j293_2	2148	45	17-OCT-1992	03:03:55	6132	92307j314_2	1940	45	5-NOV-1992	04:12:55	6290	92328j335_2	1674	65	26-NOV-1992	12:58:15
5992	92286j293_2	2150	45	17-OCT-1992	06:18:25	6133	92307j314_2	34	45	5-NOV-1992	07:27:25	6291	92328j335_2	1828	65	26-NOV-1992	16:12:35
5993	92286j293_2	39	45	17-OCT-1992	09:32:55	6136	92307j314_2	528	15	5-NOV-1992	18:47:33	6292	92328j335_2	1832	15	26-NOV-1992	19:26:45
5995	92286j293_2	361	15	17-OCT-1992	18:06:25	6137	92307j314_2	1266	15	5-NOV-1992	20:24:45	6293	92328j335_2	1829	15	26-NOV-1992	22:41:05
5996	92286j293_2	2145	15	17-OCT-1992	19:16:15	6137	92307j314_2	36	45	5-NOV-1992	22:24:45	6294	92328j335_2	728	15	27-NOV-1992	01:55:35
5997	92286j293_2	2134	15	17-OCT-1992	22:30:45	6138	92307j314_2	1934	45	5-NOV-1992	23:39:15	6295	92328j335_2	1806	45	27-NOV-1992	05:09:55
5998	92286j293_2	39	15	18-OCT-1992	01:45:15	6139	92307j314_2	1937	45	6-NOV-1992	02:53:45	6297	92328j335_2	1009	65	27-NOV-1992	12:06:53
6000	92286j293_2	101	65	18-OCT-1992	11:11:45	6140	92307j314_2	2009	45	6-NOV-1992	06:08:15	6298	92328j335_2	1824	65	27-NOV-1992	14:53:05
6001	92286j293_2	2142	65	18-OCT-1992	11:28:35	6142	92307j314_2	1941	65	6-NOV-1992	12:36:55	6299	92328j335_2	882	65	27-NOV-1992	18:07:25
6002	92286j293_2	2127	65	18-OCT-1992	14:43:05	6143	92307j314_2	1901	65	6-NOV-1992	15:51:15	6301	92328j335_2	1825	45	28-NOV-1992	00:36:15
6003	92286j293_2	2103	15	18-OCT-1992	18:58:13	6144	92307j314_2	1659	15	6-NOV-1992	19:05:45	6302	92328j335_2	1832	45	28-NOV-1992	03:50:35
6003	92286j293_2	38	65	18-OCT-1992	17:57:25	6145	92307j314_2	1510	45	6-NOV-1992	23:10:55	6303	92328j335_2	1830	45	28-NOV-1992	07:05:05
6004	92286j293_2	38	15	18-OCT-1992	21:11:55	6146	92307j314_2	1604	45	7-NOV-1992	02:25:25	6304	92328j335_2	1801	45	28-NOV-1992	10:19:25
6005	92286j293_2	2100	45	19-OCT-1992	01:27:07	6147	92307j314_2	1606	45	7-NOV-1992	05:39:45	6307	92328j335_2	1805	15	28-NOV-1992	20:02:15
6006	92286j300_2	2122	45	19-OCT-1992	03:40:55	6149	92307j314_2	32	65	7-NOV-1992	12:17:43	6308	92328j335_2	1598	45	28-NOV-1992	23:16:35
6007	92293j300_2	2103	45	19-OCT-1992	07:00:05	6150	92307j314_2	1284	15	7-NOV-1992	18:51:15	6309	92328j335_2	1834	45	29-NOV-1992	02:30:55
6008	92293j300_2	37	45	19-OCT-1992	10:09:45	6152	92307j314_2	198	15	7-NOV-1992	21:51:55	6310	92328j335_2	1817	45	29-NOV-1992	05:45:25
6008	92293j300_2	2084	65	19-OCT-1992	11:10:27	6153	92307j314_2	593	45	7-NOV-1992	22:27:09	6311	92328j335_2	1833	45	29-NOV-1992	08:59:45
6009	92293j300_2	1741	65	19-OCT-1992	13:24:15	6153	92307j314_2	1592	45	8-NOV-1992	01:06:25	6314	92328j335_2	890	15	29-NOV-1992	19:14:55
6010	92293j300_2	940	15	19-OCT-1992	18:17:43	6154	92307j314_2	1606	45	8-NOV-1992	04:20:45	6315	92328j335_2	79	45	29-NOV-1992	22:56:29
6011	92293j300_2	2129	15	19-OCT-1992	19:53:05	6154	92307j314_2	1606	45	8-NOV-1992	04:20:45	6316	92328j335_2	1837	45	30-NOV-1992	01:11:25
6012	92293j300_2	1996	15	19-OCT-1992	23:07:35	6155	92307j314_2	1601	45	8-NOV-1992	07:35:15	6320	92335j342_2	1539	65	30-NOV-1992	14:08:55
6013	92293j300_2	233	45	20-OCT-1992	04:47:45	6156	92307j314_2	15	45	8-NOV-1992	10:49:35	6321	92335j342_2	1829	65	30-NOV-1992	17:23:15
6014	92293j300_2	2069	45	20-OCT-1992	05:36:25	6159	92307j314_2	1609	15	8-NOV-1992	20:32:45	6322	92335j342_2	1824	15	30-NOV-1992	20:37:35
6015	92293j300_2	38	45	20-OCT-1992	08:50:55	6160	92307j314_2	1607	45	8-NOV-1992	23:47:05	6323	92335j342_2	1781	15	30-NOV-1992	23:52:05
6018	92293j300_2	2085	15	20-OCT-1992	19:34:53	6161	92307j314_2	1608	45	9-NOV-1992	03:01:35	6326	92335j342_2	1825	45	1-DEC-1992	09:35:25
6019	92293j300_2	546	15	20-OCT-1992	21:48:45	6162	92307j321_2	1829	45	9-NOV-1992	06:15:55	6329	92335j342_2	1810	15	1-DEC-1992	19:18:05
6019	92293j300_2	102	45	21-OCT-1992	00:46:15	6163	92307j321_2	1861	45	9-NOV-1992	09:30:25	6330	92335j342_2	1043	15	1-DEC-1992	22:59:29
6020	92293j300_2	1288	45	21-OCT-1992	01:03:15	6164	92307j321_2	1854	65	9-NOV-1992	12:44:55	6331	92335j342_2	1821	45	2-DEC-1992	01:46:45
6022	92293j300_2	1973	45	21-OCT-1992	08:32:45	6170	92314j321_2	1871	45	10-NOV-1992	08:11:15	6332	92335j342_2	1830	45	2-DEC-1992	05:01:15
6023	92293j300_2	2074	65	21-OCT-1992	11:47:09	6171	92314j321_2	1167	65	10-NOV-1992	11:50:19	6335	92335j342_2	1812	65	2-DEC-1992	14:44:15
6024	92293j300_2	30	65	21-OCT-1992	14:00:55	6172	92314j321_2	1857	65	10-NOV-1992	14:40:05	6336	92335j342_2	1478	65	2-DEC-1992	17:58:35
6025	92293j300_2	2033	15	21-OCT-1992	18:17:37	6173	92314j321_2	495	65	10-NOV-1992	17:54:25	6343	92335j342_2	1529	65	3-DEC-1992	16:39:05
6026	92293j300_2	2117	15	21-OCT-1992	20:29:55	6175	92314j321_2	1869	45	11-NOV-1992	00:23:15	6345	92335j342_2	1957	45	3-DEC-1992	23:07:45
6027	92293j300_2	1792	15	21-OCT-1992	23:44:15	6176	92314j321_2	1845	45	11-NOV-1992	03:37:45	6346	92335j342_2	823	45	4-DEC-1992	02:22:05
6028	92293j300_2	1048	45	22-OCT-1992	04:33:29	6177	92314j321_2	1866	45	11-NOV-1992	06:52:15	6349	92335j342_2	1768	65	4-DEC-1992	12:07:19
6029	92293j300_2	1982	45	22-OCT-1992	06:13:15	6178	92314j321_2	1705	45	11-NOV-1992	10:06:45	6350	92335j342_2	1820	65	4-DEC-1992	15:19:35
6030	92293j300_2	1079	65	22-OCT-1992	11:08:13	6181	92314j321_2	1858	15	11-NOV-1992	19:49:45	6352	92335j342_2	1770	15	4-DEC-1992	21:48:15
6031	92293j300_2	1249	65	22-OCT-1992	12:42:05	6182	92314j321_2	1867									

6439	92349j356.2	1157	65	16-DEC-1992	15:35:15	6641	93011j018.2	1830	15	12-JAN-1993	21:45:05	6769	93025j032.2	4	45	30-JAN-1993	06:10:55
6442	92349j356.2	1779	45	17-DEC-1992	01:18:15	6642	93011j018.2	1702	15	13-JAN-1993	00:59:15	6770	93025j032.2	1559	45	30-JAN-1993	06:11:35
6443	92349j356.2	1795	45	17-DEC-1992	04:32:35	6643	93011j018.2	1814	45	13-JAN-1993	04:15:53	6771	93025j032.2	54	45	30-JAN-1993	09:25:55
6444	92349j356.2	1829	45	17-DEC-1992	07:46:55	6644	93011j018.2	1834	45	13-JAN-1993	07:27:45	6773	93025j032.2	166	15	30-JAN-1993	18:01:33
6445	92349j356.2	731	45	17-DEC-1992	11:01:15	6647	93011j018.2	1822	65	13-JAN-1993	17:10:55	6774	93025j032.2	2018	15	30-JAN-1993	19:08:35
6445	92349j356.2	179	65	17-DEC-1992	11:57:51	6648	93011j018.2	1597	15	13-JAN-1993	21:08:05	6775	93025j032.2	1892	15	30-JAN-1993	22:22:45
6446	92349j356.2	1823	65	17-DEC-1992	14:15:35	6649	93011j018.2	1801	15	13-JAN-1993	23:39:25	6775	93025j032.2	2	45	31-JAN-1993	01:36:35
6447	92349j356.2	1828	65	17-DEC-1992	17:29:55	6650	93011j018.2	1894	45	14-JAN-1993	02:53:35	6776	93025j032.2	2014	45	31-JAN-1993	01:36:55
6449	92349j356.2	1790	45	17-DEC-1992	23:58:25	6654	93011j018.2	1830	65	14-JAN-1993	15:50:55	6777	93025j032.2	1894	45	31-JAN-1993	04:51:15
6450	92349j356.2	1832	45	18-DEC-1992	03:12:45	6655	93011j018.2	1814	15	14-JAN-1993	19:05:05	6778	93025j032.2	181	45	31-JAN-1993	08:05:25
6451	92349j356.2	1829	45	18-DEC-1992	06:27:05	6656	93011j018.2	1821	15	14-JAN-1993	22:19:15	6782	93025j032.2	2017	15	31-JAN-1993	21:02:15
6452	92349j356.2	1831	45	18-DEC-1992	09:41:25	6657	93011j018.2	1820	45	15-JAN-1993	01:33:45	6783	93025j032.2	20	15	1-FEB-1993	00:16:35
6453	92349j356.2	1739	65	18-DEC-1992	12:55:45	6658	93011j018.2	1799	45	15-JAN-1993	04:47:55	6783	93025j032.2	1878	45	1-FEB-1993	00:38:35
6454	92349j356.2	1832	65	18-DEC-1992	16:10:05	6659	93011j018.2	1828	45	15-JAN-1993	08:02:15	6784	93025j032.2	1987	45	1-FEB-1993	03:30:45
6456	92349j356.2	442	45	18-DEC-1992	23:26:19	6661	93011j018.2	42	65	15-JAN-1993	15:32:17	6789	93032j039.2	1706	15	1-FEB-1993	21:06:49
6457	92349j356.2	1833	45	19-DEC-1992	01:53:15	6662	93011j018.2	1813	65	15-JAN-1993	17:45:25	6790	93032j039.2	1590	15	1-FEB-1993	23:00:15
6458	92349j356.2	494	45	19-DEC-1992	05:07:25	6663	93011j018.2	1841	15	15-JAN-1993	21:00:35	6790	93032j039.2	386	45	2-FEB-1993	01:04:59
6460	92349j356.2	1269	65	19-DEC-1992	11:55:37	6663	93011j018.2	50	65	15-JAN-1993	20:03:25	6791	93032j039.2	1893	45	2-FEB-1993	02:10:55
6461	92349j356.2	1832	65	19-DEC-1992	14:50:25	6664	93011j018.2	1688	15	15-JAN-1993	23:02:45	6792	93032j039.2	2017	45	2-FEB-1993	05:25:15
6462	92349j356.2	1820	65	19-DEC-1992	18:04:45	6664	93011j018.2	259	45	16-JAN-1993	01:08:29	6793	93032j039.2	20	45	2-FEB-1993	08:19:25
6464	92349j356.2	1835	45	20-DEC-1992	00:33:25	6665	93011j018.2	771	45	16-JAN-1993	02:31:55	6793	93032j039.2	967	65	2-FEB-1993	10:38:45
6465	92349j356.2	1833	45	20-DEC-1992	03:47:45	6665	93011j018.2	1824	45	16-JAN-1993	05:48:25	6794	93032j039.2	161	65	2-FEB-1993	11:53:45
6468	92349j356.2	1833	65	20-DEC-1992	13:30:35	6667	93011j018.2	1580	45	16-JAN-1993	09:00:35	6797	93032j039.2	1898	15	2-FEB-1993	21:36:35
6469	92349j356.2	1825	65	20-DEC-1992	16:45:05	6669	93011j018.2	4	15	16-JAN-1993	18:27:45	6798	93032j039.2	182	15	3-FEB-1993	00:50:55
6475	92356j363.2	1823	65	21-DEC-1992	12:10:55	6670	93011j018.2	1948	15	16-JAN-1993	18:28:15	6799	93032j039.2	1897	45	3-FEB-1993	04:06:05
6476	92356j363.2	739	65	21-DEC-1992	15:25:05	6671	93011j018.2	1896	15	16-JAN-1993	21:57:45	6800	93032j039.2	647	45	3-FEB-1993	07:19:35
6479	92356j363.2	1822	15	22-DEC-1992	01:08:05	6671	93011j018.2	22	45	17-JAN-1993	00:53:15	6801	93032j039.2	1828	65	3-FEB-1993	11:53:05
6481	92356j363.2	1823	45	22-DEC-1992	07:36:45	6672	93011j018.2	1912	45	17-JAN-1993	00:56:55	6804	93032j039.2	1852	15	3-FEB-1993	21:35:55
6482	92356j363.2	549	45	22-DEC-1992	10:51:05	6673	93011j018.2	1910	45	17-JAN-1993	04:26:25	6805	93032j039.2	1261	15	3-FEB-1993	23:53:05
6484	92356j363.2	1822	65	22-DEC-1992	17:19:45	6674	93011j018.2	1922	45	17-JAN-1993	07:25:25	6806	93032j039.2	241	45	4-FEB-1993	04:40:45
6486	92356j363.2	1831	45	22-DEC-1992	23:48:15	6675	93011j018.2	32	45	17-JAN-1993	10:54:55	6807	93032j039.2	1868	45	4-FEB-1993	05:59:25
6487	92356j363.2	1828	45	23-DEC-1992	03:02:35	6677	93011j018.2	1687	15	17-JAN-1993	18:26:45	6810	93032j039.2	530	15	4-FEB-1993	17:46:11
6491	92356j363.2	1825	65	23-DEC-1992	15:59:55	6678	93011j018.2	1919	15	17-JAN-1993	20:22:25	6811	93032j039.2	1902	15	4-FEB-1993	18:56:35
6492	92356j363.2	468	65	23-DEC-1992	19:14:15	6679	93011j018.2	47	15	17-JAN-1993	23:52:05	6812	93032j039.2	1786	15	4-FEB-1993	22:10:55
6494	92356j363.2	1828	45	24-DEC-1992	01:42:45	6680	93011j018.2	1857	45	18-JAN-1993	00:49:25	6813	93032j039.2	1889	45	5-FEB-1993	01:25:25
6495	92356j363.2	960	45	24-DEC-1992	04:57:15	6681	93011j025.2	1902	45	18-JAN-1993	02:50:55	6814	93032j039.2	2010	45	5-FEB-1993	04:39:35
6499	92356j363.2	1830	65	24-DEC-1992	17:54:25	6682	93018j025.2	34	45	18-JAN-1993	06:20:45	6818	93032j039.2	1961	15	5-FEB-1993	17:45:15
6501	92356j363.2	1823	15	25-DEC-1992	00:23:05	6685	93018j025.2	1640	15	18-JAN-1993	09:19:25	6819	93032j039.2	1886	15	5-FEB-1993	21:13:05
6509	92356j363.2	1827	45	26-DEC-1992	02:17:25	6686	93018j025.2	1596	15	18-JAN-1993	20:23:21	6820	93032j039.2	182	15	6-FEB-1993	00:05:15
6512	92356j363.2	1829	65	26-DEC-1992	12:00:25	6686	93018j025.2	261	45	19-JAN-1993	00:22:51	6821	93032j039.2	1814	45	6-FEB-1993	01:24:35
6513	92356j363.2	1830	65	26-DEC-1992	15:14:45	6687	93018j025.2	1912	45	19-JAN-1993	01:46:25	6822	93032j039.2	1701	45	6-FEB-1993	03:41:35
6514	92356j363.2	1830	65	26-DEC-1992	18:29:05	6688	93018j025.2	1965	45	19-JAN-1993	04:45:05	6825	93032j039.2	1499	15	6-FEB-1993	17:45:09
6516	92356j363.2	1827	45	27-DEC-1992	00:57:35	6689	93018j025.2	690	45	19-JAN-1993	08:15:05	6826	93032j039.2	2017	15	6-FEB-1993	19:30:55
6517	92356j363.2	1828	45	27-DEC-1992	04:11:55	6692	93018j025.2	135	65	19-JAN-1993	17:42:05	6827	93032j039.2	1798	15	6-FEB-1993	23:07:15
6523	92356j363.2	1663	45	27-DEC-1992	23:44:35	6695	93018j025.2	247	45	20-JAN-1993	05:08:45	6828	93032j039.2	2008	45	7-FEB-1993	01:04:59
6524	92356j363.2	1724	45	28-DEC-1992	02:52:05	6696	93018j025.2	1926	45	20-JAN-1993	06:39:05	6829	93032j039.2	1884	45	7-FEB-1993	01:59:35
6525	92356j004.2	1834	45	28-DEC-1992	06:06:25	6697	93018j025.2	48	45	20-JAN-1993	10:09:35	6830	93032j039.2	103	45	7-FEB-1993	08:28:15
6526	92363j004.2	1832	45	28-DEC-1992	09:20:45	6701	93018j025.2	1867	15	20-JAN-1993	23:07:45	6833	93032j039.2	1879	15	7-FEB-1993	18:33:05
6527	92363j004.2	1830	65	28-DEC-1992	12:35:05	6705	93018j025.2	1900	65	21-JAN-1993	12:03:45	6834	93032j039.2	1971	15	7-FEB-1993	21:25:25
6528	92363j004.2	1833	65	28-DEC-1992	15:49:15	6706	93018j025.2	1973	65	21-JAN-1993	15:01:35	6835	93032j039.2	11	15	8-FEB-1993	01:01:45
6529	92363j004.2	1254	65	28-DEC-1992	19:03:45	6707	93018j025.2	389	15	21-JAN-1993	20:19:41	6835	93032j039.2	1864	45	8-FEB-1993	01:05:05
6530	92363j004.2	752	15	28-DEC-1992	22:55:03	6707	93018j025.2	50	65	21-JAN-1993	18:32:25	6836	93032j046.2	2007	45	8-FEB-1993	03:54:25
6531	92363j004.2	1824	45	29-DEC-1992	01:32:15	6708	93018j025.2	1983	15	21-JAN-1993	21:30:05	6837	93032j046.2	499	45	8-FEB-1993	07:30:15
6532	92363j004.2	70	45	29-DEC-1992	04:46:55	6709	93018j025.2	1415	45	22-JAN-1993	01:00:55	6840	93039j046.2	1823	15	8-FEB-1993	18:10:15
6534	92363j004.2	195	65	29-DEC-1992	12:10:55	6712	93018j025.2	1669	65	22-JAN-1993	11:41:25	6841	93039j046.2	1732	15	8-FEB-1993	20:27:25
6535	92363j004.2	1831	65	29-DEC-1992	14:29:25	6714	93018j025.2	19	15	22-JAN-1993	20:04:45	6842	93039j046.2	178	15	8-FEB-1993	23:19:35
6536	92363j004.2	1803	65	29-DEC-1992	17:43:45	6715	93018j025.2	1880	15	22-JAN-1993	20:26:45	6845	93039j046.2	1259	65	9-FEB-1993	10:44:37
6537	92363j004.2	1830	15	29-DEC-1992	20:58:05	6716	93018j025.2	911	15	23-JAN-1993	01:10:09	6846	93039j046.2	93	65	9-FEB-1993	12:30:55
6538	92363j004.2	1831	45	30-DEC-1992	00:12:25	6719	93018j025.2	1077	65	23-JAN-1993	10:48:17	6848	93039j046.2	1824	15	9-FEB-1993	20:04:35
6539	92363j004.2	1824	45	30-DEC-1992	03:26:45	6720	93018j025.2	1997	65	23-JAN-1993	12:20:55	6849	93039j046.2	1883	15	9-FEB-1993	22:24:05

6922	93046j053_2	1967	15	19-FEB-1993	18:37:25	7038	93060j067_2	419	65	7-MAR-1993	12:06:45	7202	93081j095_2	1833	15	29-MAR-1993	14:20:45
6923	93046j053_2	1895	15	19-FEB-1993	21:57:15	7039	93060j067_2	87	15	7-MAR-1993	16:28:15	7203	93081j095_2	1977	15	29-MAR-1993	16:35:55
6923	93046j053_2	87	45	20-FEB-1993	00:51:25	7039	93060j067_2	1862	65	7-MAR-1993	13:34:15	7204	93081j095_2	1880	15	29-MAR-1993	19:44:05
6924	93046j053_2	1929	45	20-FEB-1993	01:05:55	7040	93060j067_2	1926	15	7-MAR-1993	16:42:45	7204	93081j095_2	40	45	29-MAR-1993	21:49:57
6925	93046j053_2	555	45	20-FEB-1993	04:25:45	7041	93060j067_2	1963	15	7-MAR-1993	20:02:45	7205	93081j095_2	1976	45	29-MAR-1993	23:04:25
6927	93046j053_2	1177	65	20-FEB-1993	12:19:05	7042	93060j067_2	1925	15	7-MAR-1993	23:11:15	7206	93081j095_2	1930	45	30-MAR-1993	02:12:35
6928	93046j053_2	1925	65	20-FEB-1993	14:03:05	7045	93060j074_2	11	65	8-MAR-1993	12:06:35	7207	93081j095_2	17	45	30-MAR-1993	05:32:55
6929	93046j053_2	1982	15	20-FEB-1993	17:22:55	7046	93067j074_2	1931	65	8-MAR-1993	12:07:25	7209	93081j095_2	82	15	30-MAR-1993	14:55:35
6930	93046j053_2	1923	15	20-FEB-1993	20:31:45	7047	93067j074_2	1920	15	8-MAR-1993	16:27:35	7210	93081j095_2	1917	15	30-MAR-1993	15:09:45
6931	93046j053_2	61	15	20-FEB-1993	23:51:35	7047	93067j074_2	59	65	8-MAR-1993	15:28:35	7211	93081j095_2	61	15	30-MAR-1993	18:30:05
6931	93046j053_2	1923	45	21-FEB-1993	00:50:35	7048	93067j074_2	1928	15	8-MAR-1993	18:37:05	7213	93081j095_2	85	45	31-MAR-1993	03:52:35
6932	93046j053_2	1924	45	21-FEB-1993	03:00:15	7049	93067j074_2	1534	15	8-MAR-1993	21:57:05	7214	93081j095_2	1950	45	31-MAR-1993	04:06:45
6933	93046j053_2	1722	45	21-FEB-1993	06:20:05	7049	93067j074_2	409	45	8-MAR-1993	23:45:59	7218	93081j095_2	1829	15	31-MAR-1993	18:09:05
6935	93046j053_2	1986	65	21-FEB-1993	12:48:35	7050	93067j074_2	1927	45	9-MAR-1993	01:05:35	7219	93081j095_2	1891	15	31-MAR-1993	20:24:15
6936	93046j053_2	1834	15	21-FEB-1993	17:02:05	7051	93067j074_2	1958	45	9-MAR-1993	04:25:35	7221	93081j095_2	1422	45	1-APR-1993	04:03:07
6936	93046j053_2	94	65	21-FEB-1993	15:57:25	7053	93067j074_2	1	65	9-MAR-1993	14:02:30	7222	93081j095_2	98	45	1-APR-1993	06:00:55
6937	93046j053_2	1986	15	21-FEB-1993	19:17:15	7054	93067j074_2	250	15	9-MAR-1993	16:00:53	7224	93081j095_2	762	15	1-APR-1993	14:11:17
6938	93046j053_2	1475	15	21-FEB-1993	22:26:05	7054	93067j074_2	1608	65	9-MAR-1993	14:03:30	7225	93081j095_2	1924	15	1-APR-1993	15:50:05
6938	93046j053_2	438	45	22-FEB-1993	00:17:57	7055	93067j074_2	2036	15	9-MAR-1993	17:22:45	7226	93081j095_2	1891	15	1-APR-1993	18:58:05
6939	93046j053_2	1975	45	22-FEB-1993	01:45:45	7056	93067j074_2	1927	15	9-MAR-1993	20:31:25	7227	93081j095_2	1917	45	1-APR-1993	22:20:25
6940	93046j053_2	1324	45	22-FEB-1993	04:54:35	7057	93067j074_2	1921	45	10-MAR-1993	00:50:25	7228	93081j095_2	1928	45	2-APR-1993	01:26:35
6942	93053j060_2	1824	65	22-FEB-1993	12:27:45	7058	93067j074_2	1929	45	10-MAR-1993	02:59:55	7229	93081j095_2	56	45	2-APR-1993	04:07:05
6943	93053j060_2	1974	65	22-FEB-1993	14:42:55	7059	93067j074_2	653	45	10-MAR-1993	06:19:55	7231	93081j095_2	224	15	2-APR-1993	14:09:23
6944	93053j060_2	1911	65	22-FEB-1993	17:51:45	7061	93067j074_2	5	15	10-MAR-1993	15:56:15	7232	93081j095_2	1922	15	2-APR-1993	14:23:45
6945	93053j060_2	1957	15	22-FEB-1993	21:11:35	7062	93067j074_2	1924	15	10-MAR-1993	15:57:05	7233	93081j095_2	61	15	2-APR-1993	17:44:05
6945	93053j060_2	18	45	23-FEB-1993	00:17:25	7063	93067j074_2	61	15	10-MAR-1993	19:16:55	7234	93081j095_2	1827	45	2-APR-1993	21:57:25
6946	93053j060_2	1132	45	23-FEB-1993	00:20:25	7066	93067j074_2	1896	45	11-MAR-1993	04:58:25	7235	93081j095_2	1884	45	3-APR-1993	00:12:45
6947	93053j060_2	1971	45	23-FEB-1993	03:40:05	7069	93067j074_2	1712	15	11-MAR-1993	15:49:19	7239	93081j095_2	1913	15	3-APR-1993	14:08:55
6948	93053j060_2	579	45	23-FEB-1993	06:48:55	7070	93067j074_2	1857	15	11-MAR-1993	17:51:25	7240	93081j095_2	1926	15	3-APR-1993	16:17:55
6949	93053j060_2	1891	65	23-FEB-1993	10:08:35	7071	93067j074_2	1973	15	11-MAR-1993	21:11:15	7241	93081j095_2	1965	15	3-APR-1993	19:38:25
6951	93053j060_2	1920	15	23-FEB-1993	17:36:15	7072	93067j074_2	94	15	12-MAR-1993	00:19:55	7243	93081j095_2	1899	45	4-APR-1993	03:06:05
6952	93053j060_2	1924	15	23-FEB-1993	19:46:05	7073	93067j074_2	1921	45	12-MAR-1993	04:38:55	7244	93081j095_2	97	45	4-APR-1993	05:15:05
6953	93053j060_2	1566	45	24-FEB-1993	00:17:19	7074	93067j074_2	454	45	12-MAR-1993	06:48:35	7246	93081j095_2	28	15	4-APR-1993	13:50:01
6954	93053j060_2	1915	45	24-FEB-1993	02:14:45	7074	93067j074_2	1060	65	12-MAR-1993	08:11:55	7247	93081j095_2	1961	15	4-APR-1993	15:04:05
6955	93053j060_2	1948	45	24-FEB-1993	05:34:25	7075	93067j074_2	188	65	12-MAR-1993	10:08:25	7248	93081j095_2	1919	15	4-APR-1993	18:12:05
6956	93053j060_2	92	45	24-FEB-1993	08:43:15	7077	93067j074_2	1923	15	12-MAR-1993	16:36:55	7249	93081j095_2	1961	45	4-APR-1993	21:32:35
6956	93053j060_2	1820	65	24-FEB-1993	09:47:45	7079	93067j074_2	1913	45	13-MAR-1993	00:04:25	7250	93081j095_2	1927	45	5-APR-1993	00:40:45
6957	93053j060_2	1968	65	24-FEB-1993	12:02:55	7080	93067j074_2	1925	45	13-MAR-1993	02:14:05	7251	93081j095_2	477	45	5-APR-1993	04:01:05
6958	93053j060_2	1907	65	24-FEB-1993	15:11:55	7081	93067j074_2	1862	45	13-MAR-1993	05:33:55	7254	93095j102_2	1926	15	5-APR-1993	13:45:15
6959	93053j060_2	1914	15	24-FEB-1993	19:30:35	7084	93067j074_2	1828	15	13-MAR-1993	16:15:55	7255	93095j102_2	1981	15	5-APR-1993	16:58:15
6959	93053j060_2	59	65	24-FEB-1993	18:31:35	7085	93067j074_2	1969	15	13-MAR-1993	18:31:05	7256	93095j102_2	97	15	5-APR-1993	20:06:15
6960	93053j060_2	1913	15	24-FEB-1993	21:40:25	7086	93067j074_2	1746	15	13-MAR-1993	21:39:55	7256	93095j102_2	1816	45	5-APR-1993	21:11:35
6964	93053j060_2	1364	65	25-FEB-1993	11:58:19	7089	93067j074_2	1917	65	14-MAR-1993	08:27:15	7257	93095j102_2	1965	45	5-APR-1993	23:26:45
6965	93053j060_2	1958	65	25-FEB-1993	14:01:05	7090	93067j074_2	91	65	14-MAR-1993	10:36:55	7258	93095j102_2	1928	45	6-APR-1993	02:34:55
6966	93053j060_2	91	65	25-FEB-1993	17:06:15	7097	93074j081_2	1830	65	15-MAR-1993	10:21:25	7261	93095j102_2	1041	15	6-APR-1993	13:53:11
6967	93053j060_2	1976	15	25-FEB-1993	20:25:45	7099	93074j081_2	1950	15	15-MAR-1993	15:51:05	7262	93095j102_2	1924	15	6-APR-1993	15:31:55
6968	93053j060_2	91	15	25-FEB-1993	23:34:45	7100	93074j081_2	1910	15	15-MAR-1993	18:59:55	7263	93095j102_2	1590	15	6-APR-1993	18:52:25
6968	93053j060_2	1582	45	26-FEB-1993	00:47:35	7101	93074j081_2	1453	15	15-MAR-1993	22:19:35	7265	93095j102_2	84	45	7-APR-1993	04:15:05
6969	93053j060_2	1980	45	26-FEB-1993	02:54:15	7102	93074j081_2	135	45	16-MAR-1993	03:16:15	7266	93095j102_2	972	45	7-APR-1993	04:29:05
6970	93053j060_2	1926	45	26-FEB-1993	06:02:25	7103	93074j081_2	1892	45	16-MAR-1993	04:48:05	7269	93095j102_2	1920	15	7-APR-1993	15:17:15
6972	93053j060_2	1047	65	26-FEB-1993	14:02:09	7107	93074j081_2	1289	15	16-MAR-1993	19:05:47	7270	93095j102_2	1920	15	7-APR-1993	17:26:05
6973	93053j060_2	1907	15	26-FEB-1993	16:50:35	7108	93074j081_2	1902	15	16-MAR-1993	20:54:05	7271	93095j102_2	1882	15	7-APR-1993	20:46:35
6973	93053j060_2	60	65	26-FEB-1993	15:51:35	7109	93074j081_2	1860	45	17-MAR-1993	01:12:55	7276	93095j102_2	1830	15	8-APR-1993	13:57:05
6974	93053j060_2	1918	15	26-FEB-1993	18:59:35	7110	93074j081_2	1921	45	17-MAR-1993	03:22:45	7277	93095j102_2	1963	15	8-APR-1993	16:12:15
6975	93053j060_2	1546	15	26-FEB-1993	22:20:05	7111	93074j081_2	60	45	17-MAR-1993	06:42:25	7278	93095j102_2	612	15	8-APR-1993	19:20:25
6975	93053j060_2	433	45	27-FEB-1993	00:12:13	7113	93074j081_2	89	15	17-MAR-1993	16:04:55	7278	93095j102_2	1280	45	8-APR-1993	20:44:47
6976	93053j060_2	1926	45	27-FEB-1993	01:28:05	7114	93074j081_2	1922	15	17-MAR-1993	16:19:45	7279	93095j102_2	1966	45	8-APR-1993	20:40:45
6977	93053j060_2	1975	45	27-FEB-1993	04:48:35	7115	93074j081_2	1979	15	17-MAR-1993	19:39:25	7280	93095j102_2	1926	45	9-APR-1993	01:48:55
6978	93053j060_2	405	45	27-FEB-1993	07:56:45	7116	93074j081_2	315	15	17-MAR-1993	22:48:25	7281	93095j102_2	34	45	9-APR-1993	05:09:45
6981	93053j060_2	1983	15	27-FEB-1993	17:45:45	7118	93074j081_2	1851	45	18-MAR-1993	05:30:35	7281	93095j102_2	1916	65	9-APR-199	



7343	93102j109_2	1974	15	17-APR-1993	13:53:55	7449	93116j123_2	1957	45	1-MAY-1993	21:02:55	7573	93137j144_2	1825	15	18-MAY-1993	15:16:35
7344	93102j109_2	1920	15	17-APR-1993	17:02:45	7450	93116j123_2	1370	45	2-MAY-1993	00:10:45	7574	93137j144_2	1850	15	18-MAY-1993	17:25:45
7345	93102j109_2	1973	45	17-APR-1993	20:22:25	7451	93116j123_2	84	45	2-MAY-1993	19:21:55	7575	93137j144_2	949	15	18-MAY-1993	21:44:55
7346	93102j109_2	1913	45	17-APR-1993	23:31:15	7452	93116j123_2	1967	45	2-MAY-1993	19:35:55	7576	93137j144_2	1830	65	19-MAY-1993	07:27:15
7347	93102j109_2	1882	45	18-APR-1993	02:50:55	7453	93116j123_2	1939	45	2-MAY-1993	22:56:35	7577	93137j144_2	1829	65	19-MAY-1993	10:41:25
7349	93102j109_2	1968	65	18-APR-1993	09:20:15	7454	93116j123_2	84	45	3-MAY-1993	02:04:15	7578	93137j144_2	924	45	20-MAY-1993	00:11:37
7350	93102j109_2	1829	15	18-APR-1993	13:32:45	7455	93116j123_2	1192	65	3-MAY-1993	06:47:47	7579	93137j144_2	1833	15	20-MAY-1993	12:34:15
7350	93102j109_2	92	65	18-APR-1993	12:28:15	7456	93116j123_2	1311	65	3-MAY-1993	08:32:45	7580	93137j144_2	1844	15	20-MAY-1993	14:43:05
7351	93102j109_2	1969	15	18-APR-1993	15:47:55	7457	93116j123_2	1905	15	3-MAY-1993	12:52:35	7581	93137j144_2	1833	45	21-MAY-1993	01:30:35
7352	93102j109_2	91	15	18-APR-1993	18:56:45	7458	93116j123_2	1265	15	3-MAY-1993	15:01:05	7582	93137j144_2	1833	45	21-MAY-1993	03:39:35
7352	93102j109_2	1922	45	18-APR-1993	20:01:25	7459	93116j123_2	1247	45	3-MAY-1993	18:21:35	7583	93137j144_2	1829	65	21-MAY-1993	07:58:45
7353	93102j109_2	1978	45	18-APR-1993	22:16:35	7460	93123j130_2	1262	45	3-MAY-1993	19:20:45	7584	93137j144_2	1820	65	21-MAY-1993	11:14:35
7354	93102j109_2	1914	45	19-APR-1993	01:25:15	7461	93123j130_2	1965	45	3-MAY-1993	21:29:25	7585	93137j144_2	8	15	21-MAY-1993	15:14:45
7355	93102j109_2	58	45	19-APR-1993	04:45:05	7462	93123j130_2	99	45	4-MAY-1993	00:50:05	7586	93137j144_2	1833	15	21-MAY-1993	16:35:55
7356	93109j116_2	1830	65	19-APR-1993	08:58:25	7463	93123j130_2	1917	65	4-MAY-1993	03:57:45	7587	93137j144_2	1228	15	21-MAY-1993	20:55:05
7357	93109j116_2	853	15	19-APR-1993	12:49:35	7464	93123j130_2	2005	65	4-MAY-1993	08:17:25	7588	93137j144_2	1145	65	22-MAY-1993	07:04:09
7357	93109j116_2	955	65	19-APR-1993	11:13:35	7465	93123j130_2	865	65	4-MAY-1993	10:26:05	7589	93137j144_2	1826	65	22-MAY-1993	09:51:25
7358	93109j116_2	94	15	19-APR-1993	14:22:15	7466	93123j130_2	1855	45	4-MAY-1993	13:46:55	7590	93137j144_2	1831	15	22-MAY-1993	16:19:45
7359	93109j116_2	1880	15	19-APR-1993	17:42:05	7467	93123j130_2	1175	45	4-MAY-1993	21:17:49	7591	93137j144_2	1848	15	22-MAY-1993	18:28:35
7359	93109j116_2	88	45	19-APR-1993	20:36:05	7471	93123j130_2	1796	65	4-MAY-1993	23:22:55	7592	93137j144_2	1	45	23-MAY-1993	00:56:35
7360	93109j116_2	1926	45	19-APR-1993	20:50:45	7472	93123j130_2	61	65	5-MAY-1993	06:56:35	7593	93137j144_2	1851	45	23-MAY-1993	00:56:45
7361	93109j116_2	2137	45	20-APR-1993	00:10:17	7473	93123j130_2	1826	45	5-MAY-1993	09:11:45	7594	93137j144_2	1725	65	23-MAY-1993	07:24:55
7363	93109j116_2	515	65	20-APR-1993	08:26:17	7474	93123j130_2	61	65	5-MAY-1993	19:00:15	7595	93137j144_2	1821	15	23-MAY-1993	11:44:15
7364	93109j116_2	1896	65	20-APR-1993	09:47:45	7475	93123j130_2	1910	15	5-MAY-1993	22:08:35	7596	93137j144_2	1848	15	23-MAY-1993	13:53:05
7365	93109j116_2	1972	15	20-APR-1993	13:07:45	7476	93123j130_2	1926	15	5-MAY-1993	12:04:25	7597	93137j144_2	1834	15	23-MAY-1993	18:12:25
7366	93109j116_2	1911	15	20-APR-1993	16:16:15	7477	93123j130_2	1926	15	6-MAY-1993	14:13:55	7598	93137j144_2	1681	15	23-MAY-1993	20:21:15
7367	93109j116_2	1977	15	20-APR-1993	19:36:05	7478	93123j130_2	61	15	6-MAY-1993	17:33:45	7599	93137j144_2	1835	65	24-MAY-1993	07:08:55
7368	93109j116_2	44	15	20-APR-1993	22:44:45	7479	93123j130_2	1374	45	6-MAY-1993	18:52:45	7600	93137j144_2	1847	65	24-MAY-1993	09:17:35
7369	93109j116_2	1891	45	21-APR-1993	02:04:35	7483	93123j130_2	1906	45	6-MAY-1993	20:42:15	7601	93137j144_2	1	15	24-MAY-1993	15:45:35
7371	93109j116_2	1905	65	21-APR-1993	09:32:05	7484	93123j130_2	1661	45	7-MAY-1993	00:02:05	7602	93137j144_2	1832	65	24-MAY-1993	13:36:55
7372	93109j116_2	1824	15	21-APR-1993	12:46:25	7485	93123j130_2	644	45	7-MAY-1993	03:10:45	7603	93137j144_2	1851	15	24-MAY-1993	15:45:35
7372	93109j116_2	94	65	21-APR-1993	11:41:45	7486	93123j130_2	259	65	7-MAY-1993	08:06:25	7604	93137j144_2	1833	15	24-MAY-1993	20:05:15
7373	93109j116_2	432	15	21-APR-1993	15:01:45	7487	93123j130_2	1888	65	7-MAY-1993	09:39:05	7605	93137j144_2	1815	24-MAY-1993	22:13:45	
7374	93109j116_2	1100	45	21-APR-1993	19:40:41	7488	93123j130_2	1972	15	7-MAY-1993	12:58:45	7606	93137j144_2	508	45	16-AUG-1993	20:33:57
7375	93109j116_2	1891	45	21-APR-1993	21:30:05	7489	93123j130_2	94	15	7-MAY-1993	16:07:25	7607	93228j235_2	640	45	17-AUG-1993	20:46:51
7378	93109j116_2	1529	65	22-APR-1993	08:21:27	7490	93123j130_2	1838	45	7-MAY-1993	20:25:15	7608	93228j235_2	507	45	17-AUG-1993	21:46:13
7379	93109j116_2	87	15	22-APR-1993	13:21:05	7491	93123j130_2	1841	45	7-MAY-1993	22:35:45	7609	93228j235_2	651	45	17-AUG-1993	23:55:35
7379	93109j116_2	59	65	22-APR-1993	10:27:05	7492	93123j130_2	1943	45	7-MAY-1993	02:53:35	7610	93228j235_2	644	15	18-AUG-1993	12:32:01
7380	93109j116_2	1925	15	22-APR-1993	13:35:35	7493	93123j130_2	1827	65	8-MAY-1993	09:21:55	7611	93228j235_2	509	15	18-AUG-1993	13:31:21
7381	93109j116_2	1916	15	22-APR-1993	16:55:35	7494	93123j130_2	1815	15	8-MAY-1993	12:36:05	7612	93228j235_2	71	45	18-AUG-1993	20:03:53
7382	93109j116_2	1916	15	22-APR-1993	20:04:05	7495	93123j130_2	11	65	8-MAY-1993	11:31:55	7613	93228j235_2	505	15	19-AUG-1993	14:43:35
7383	93109j116_2	1916	45	23-APR-1993	00:23:05	7496	93123j130_2	1817	65	8-MAY-1993	08:01:05	7614	93228j235_2	499	45	19-AUG-1993	20:06:11
7384	93109j116_2	1915	45	23-APR-1993	02:32:35	7497	93123j130_2	1822	65	9-MAY-1993	11:15:15	7615	93228j235_2	505	45	19-AUG-1993	21:01:39
7385	93109j116_2	1971	65	23-APR-1993	05:52:35	7498	93123j130_2	7	45	9-MAY-1993	19:52:15	7616	93228j235_2	1678	45	19-AUG-1993	22:36:09
7386	93109j116_2	1919	65	23-APR-1993	09:01:05	7499	93123j130_2	1845	45	9-MAY-1993	19:53:25	7617	93228j235_2	420	45	20-AUG-1993	00:13:35
7387	93109j116_2	1917	15	23-APR-1993	13:20:05	7500	93123j130_2	1829	45	9-MAY-1993	00:11:55	7618	93228j235_2	1690	45	20-AUG-1993	20:39:23
7387	93109j116_2	59	65	23-APR-1993	12:20:55	7501	93123j130_2	1827	45	10-MAY-1993	02:21:45	7619	93228j235_2	501	45	20-AUG-1993	22:13:53
7388	93109j116_2	1922	15	23-APR-1993	15:29:25	7502	93123j130_2	576	65	10-MAY-1993	07:23:35	7620	93228j235_2	1689	45	20-AUG-1993	23:48:25
7389	93109j116_2	59	15	23-APR-1993	18:49:35	7503	93123j130_2	548	65	10-MAY-1993	08:49:55	7621	93228j235_2	501	65	21-AUG-1993	04:31:59
7389	93109j116_2	1915	45	23-APR-1993	19:48:35	7504	93123j130_2	1825	15	10-MAY-1993	13:08:35	7622	93228j235_2	1690	65	21-AUG-1993	06:06:27
7390	93109j116_2	1924	45	23-APR-1993	21:57:55	7505	93123j130_2	1815	15	10-MAY-1993	15:18:15	7623	93228j235_2	513	65	21-AUG-1993	07:40:59
7391	93109j116_2	1976	45	24-APR-1993	01:17:55	7506	93123j130_2	1819	45	10-MAY-1993	19:36:55	7624	93228j235_2	1689	15	21-AUG-1993	12:24:33
7392	93109j116_2	93	45	24-APR-1993	04:26:25	7507	93123j130_2	1848	45	10-MAY-1993	21:46:35	7625	93228j235_2	505	15	21-AUG-1993	13:59:03
7393	93109j116_2	1580	65	24-APR-1993	08:57:49	7508	93123j130_2	1828	45	11-MAY-1993	02:05:05	7626	93228j235_2	798	15	21-AUG-1993	15:33:33
7394	93109j116_2	789	15	24-APR-1993	12:35:53	7509	93123j130_2	13	45	11-MAY-1993	04:14:45	7627	93228j235_2	499	45	21-AUG-1993	20:17:07
7394	93109j116_2	964	65	24-APR-1993	10:54:55	7510	93123j130_2	1671	15	11-MAY-1993	11:53:51	7628	93228j235_2	1613	45	21-AUG-1993	21:51:37
7395	93109j116_2	1968	15	24-APR-1993	14:14:55	7511	93123j130_2	1840	15	11-MAY-1993	15:01:45	7629	93228j235_2	1682	65	22-AUG-1993	04:09:43
7396	93109j116_2	1926	15	24-APR-1993	17:23:15	7512	93123j130_2	11	15	11-MAY-1993	17:11:25	7630	93228j235_2	499	65	22-AUG-1993	05:44:11
7397	93109j116_2	1979	45	24-APR-1993	20:43:25	7513	93123j130_2	1812	45	11-MAY-1993	21:30:15	7631	93228j235_2	1306	65	22-AUG-1993	07:18:41
7398	93109j116_2	1911	45	24-APR-1993	23:51:45	7514	93123j130_2	183									

8754 93235j242.2	1225 15	29-AUG-1993	15:44:39	9026 93256j263.2	1049 15	16-SEP-1993	12:30:19	9366 93277j284.2	1746 45	8-OCT-1993	20:09:17
8762 93235j242.2	1671 65	30-AUG-1993	04:20:49	9027 93256j263.2	1710 15	16-SEP-1993	13:46:37	9367 93277j284.2	368 45	8-OCT-1993	21:43:21
8763 93235j242.2	1675 65	30-AUG-1993	05:55:21	9028 93256j263.2	1286 15	16-SEP-1993	15:21:27	9372 93277j284.2	1584 65	9-OCT-1993	05:41:49
8764 93242j249.2	789 65	30-AUG-1993	07:29:51	9031 93256j263.2	1426 45	16-SEP-1993	20:08:51	9373 93277j284.2	1162 65	9-OCT-1993	07:11:21
8772 93242j249.2	1562 45	30-AUG-1993	20:10:17	9032 93256j263.2	1694 45	16-SEP-1993	21:39:29	9377 93277j284.2	340 15	9-OCT-1993	13:29:29
8773 93242j249.2	1694 45	30-AUG-1993	21:40:29	9033 93256j263.2	155 45	16-SEP-1993	23:13:59	9378 93277j284.2	1746 15	9-OCT-1993	15:04:43
8774 93242j249.2	1692 45	30-AUG-1993	23:14:59	9034 93256j263.2	287 45	17-SEP-1993	00:48:25	9382 93277j284.2	1071 45	9-OCT-1993	21:23:41
8775 93242j249.2	808 45	31-AUG-1993	00:49:31	9041 93256j263.2	541 15	17-SEP-1993	12:28:43	9387 93277j284.2	552 65	10-OCT-1993	05:56:37
8782 93242j249.2	465 15	31-AUG-1993	12:32:11	9042 93256j263.2	1673 15	17-SEP-1993	13:24:35	9388 93277j284.2	1378 65	10-OCT-1993	06:51:03
8783 93242j249.2	32 15	31-AUG-1993	13:50:43	9043 93256j263.2	1702 15	17-SEP-1993	14:59:01	9392 93277j284.2	1667 15	10-OCT-1993	13:12:49
8785 93242j249.2	73 15	31-AUG-1993	16:37:29	9044 93256j263.2	740 15	17-SEP-1993	16:33:17	9393 93277j284.2	1764 15	10-OCT-1993	14:44:17
8787 93242j249.2	853 45	31-AUG-1993	20:11:43	9046 93256j263.2	736 45	17-SEP-1993	20:14:47	9397 93277j284.2	1269 45	10-OCT-1993	21:02:53
8788 93242j249.2	1694 45	31-AUG-1993	21:18:15	9047 93256j263.2	576 45	17-SEP-1993	21:16:51	9402 93277j284.2	214 65	11-OCT-1993	05:47:37
8789 93242j249.2	1688 45	31-AUG-1993	22:52:45	9052 93256j263.2	1692 65	18-SEP-1993	05:09:41	9403 93277j284.2	1768 65	11-OCT-1993	06:30:47
8790 93242j249.2	1002 45	1-SEP-1993	00:27:15	9053 93256j263.2	1705 65	18-SEP-1993	06:43:55	9407 93284j291.2	389 15	11-OCT-1993	13:34:59
8792 93242j249.2	421 65	1-SEP-1993	04:18:31	9057 93256j263.2	827 15	18-SEP-1993	13:02:13	9412 93284j291.2	1613 45	11-OCT-1993	20:42:19
8793 93242j249.2	1691 65	1-SEP-1993	05:10:51	9058 93256j263.2	191 15	18-SEP-1993	14:37:01	9418 93284j291.2	1122 65	12-OCT-1993	06:13:39
8794 93242j249.2	1687 65	1-SEP-1993	06:45:21	9059 93256j263.2	100 15	18-SEP-1993	16:11:29	9422 93284j291.2	319 15	12-OCT-1993	13:17:11
8805 93242j249.2	1679 45	2-SEP-1993	00:05:17	9067 93256j263.2	154 65	19-SEP-1993	04:55:13	9423 93284j291.2	1765 15	12-OCT-1993	14:03:39
8813 93242j249.2	1393 15	2-SEP-1993	12:41:09	9068 93256j263.2	1697 65	19-SEP-1993	06:21:49	9424 93284j291.2	665 15	12-OCT-1993	15:38:17
8814 93242j249.2	1692 15	2-SEP-1993	14:15:39	9072 93256j263.2	1703 15	19-SEP-1993	12:39:47	9427 93284j291.2	1642 45	12-OCT-1993	20:26:13
8815 93242j249.2	1687 15	2-SEP-1993	15:20:41	9071 93256j263.2	1163 15	19-SEP-1993	14:14:37	9428 93284j291.2	1781 45	12-OCT-1993	21:56:41
8816 93242j249.2	47 15	2-SEP-1993	17:24:41	9082 93256j263.2	725 65	20-SEP-1993	04:57:25	9429 93284j291.2	446 45	12-OCT-1993	23:31:17
8823 93242j249.2	1703 65	3-SEP-1993	04:26:19	9083 93256j263.2	760 65	20-SEP-1993	05:59:27	9438 93284j291.2	1775 15	13-OCT-1993	13:42:43
8824 93242j249.2	1703 65	3-SEP-1993	06:00:49	9084 93263j270.2	146 65	20-SEP-1993	07:34:13	9439 93284j291.2	1186 15	13-OCT-1993	15:17:21
8825 93242j249.2	484 65	3-SEP-1993	07:35:21	9092 93263j270.2	57 45	20-SEP-1993	20:10:23	9448 93284j291.2	1099 65	14-OCT-1993	05:52:29
8834 93242j249.2	1655 45	3-SEP-1993	21:46:59	9093 93263j270.2	1717 45	20-SEP-1993	21:44:43	9449 93284j291.2	846 65	14-OCT-1993	07:02:41
8835 93242j249.2	1497 45	3-SEP-1993	21:20:31	9103 93263j270.2	1720 15	21-SEP-1993	13:29:47	9453 93284j291.2	1795 15	14-OCT-1993	13:22:23
8838 93242j249.2	1062 65	4-SEP-1993	04:24:41	9107 93263j270.2	1037 45	21-SEP-1993	20:10:35	9454 93284j291.2	1795 15	14-OCT-1993	14:57:01
8839 93242j249.2	1683 65	4-SEP-1993	05:38:35	9108 93263j270.2	1736 45	21-SEP-1993	21:22:03	9457 93284j291.2	1198 45	14-OCT-1993	20:01:03
8840 93242j249.2	1048 65	4-SEP-1993	12:16:59	9109 93263j270.2	1297 45	21-SEP-1993	22:56:27	9458 93284j291.2	454 45	14-OCT-1993	21:15:35
8843 93242j249.2	1076 15	4-SEP-1993	13:31:11	9118 93263j270.2	1675 15	22-SEP-1993	13:07:41	9468 93284j291.2	1149 15	15-OCT-1993	13:23:09
8844 93242j249.2	1651 15	4-SEP-1993	13:31:11	9119 93263j270.2	74 15	22-SEP-1993	14:42:37	9469 93284j291.2	1807 15	15-OCT-1993	14:36:39
8845 93242j249.2	1673 15	4-SEP-1993	15:05:41	9122 93263j270.2	379 45	22-SEP-1993	20:10:15	9473 93284j291.2	206 45	15-OCT-1993	20:55:11
8846 93242j249.2	217 15	4-SEP-1993	16:40:17	9124 93263j270.2	79 45	22-SEP-1993	22:34:25	9479 93284j291.2	1814 65	16-OCT-1993	06:23:03
8848 93242j249.2	1067 45	4-SEP-1993	20:09:43	9128 93263j270.2	782 65	23-SEP-1993	05:04:27	9483 93284j291.2	499 15	16-OCT-1993	13:25:29
8849 93242j249.2	1679 45	4-SEP-1993	21:23:43	9138 93263j270.2	891 45	23-SEP-1993	21:05:23	9487 93284j291.2	157 45	16-OCT-1993	19:55:29
8850 93242j249.2	1684 45	4-SEP-1993	22:58:15	9139 93263j270.2	364 45	23-SEP-1993	22:12:21	9488 93284j291.2	1392 45	16-OCT-1993	20:33:37
8853 93242j249.2	359 65	5-SEP-1993	04:26:35	9143 93263j270.2	630 65	24-SEP-1993	05:06:37	9494 93284j291.2	1813 65	17-OCT-1993	06:02:33
8854 93242j249.2	1701 65	5-SEP-1993	05:16:21	9144 93263j270.2	1643 65	24-SEP-1993	06:05:13	9500 93284j291.2	651 15	17-OCT-1993	15:30:23
8855 93242j249.2	1689 65	5-SEP-1993	06:50:51	9145 93263j270.2	294 65	24-SEP-1993	07:39:03	9503 93284j291.2	1799 45	17-OCT-1993	20:15:19
8858 93242j249.2	789 15	5-SEP-1993	12:04:11	9149 93263j270.2	128 15	24-SEP-1993	13:57:23	9509 93284j291.2	1232 65	18-OCT-1993	06:02:05
8859 93242j249.2	1682 15	5-SEP-1993	13:08:55	9150 93263j270.2	646 15	24-SEP-1993	15:31:25	9510 93291j298.2	466 65	18-OCT-1993	07:16:45
8860 93242j249.2	1686 15	5-SEP-1993	14:43:25	9153 93263j270.2	1678 45	24-SEP-1993	20:16:33	9518 93291j298.2	1778 45	18-OCT-1993	19:55:57
8861 93242j249.2	1336 15	5-SEP-1993	16:17:59	9154 93263j270.2	1735 45	24-SEP-1993	21:51:05	9519 93291j298.2	1563 45	18-OCT-1993	21:28:11
8869 93242j249.2	1703 65	6-SEP-1993	04:54:05	9159 93263j270.2	1735 65	25-SEP-1993	05:43:35	9530 93291j298.2	1496 15	19-OCT-1993	15:01:17
8870 93242j256.2	1703 65	6-SEP-1993	06:28:35	9160 93263j270.2	770 65	25-SEP-1993	07:18:07	9531 93291j298.2	478 15	19-OCT-1993	16:24:03
8874 93242j256.2	1674 15	6-SEP-1993	12:46:39	9163 93263j270.2	1 15	25-SEP-1993	12:44:07	9536 93291j298.2	194 45	20-OCT-1993	01:12:19
8875 93242j256.2	1681 15	6-SEP-1993	14:21:11	9164 93263j270.2	1710 15	25-SEP-1993	13:37:05	9537 93291j298.2	1592 45	20-OCT-1993	01:52:07
8876 93242j256.2	16 15	6-SEP-1993	15:55:41	9165 93263j270.2	1736 15	25-SEP-1993	15:10:35	9540 93291j298.2	1634 65	20-OCT-1993	06:35:59
8889 93242j256.2	752 15	7-SEP-1993	12:25:17	9168 93263j270.2	1235 45	25-SEP-1993	20:10:57	9544 93291j298.2	641 15	20-OCT-1993	13:25:15
8890 93242j256.2	1676 15	7-SEP-1993	13:58:55	9169 93263j270.2	1740 45	25-SEP-1993	21:28:37	9545 93291j298.2	1866 15	20-OCT-1993	14:39:13
8891 93242j256.2	527 15	7-SEP-1993	15:33:27	9174 93263j270.2	1748 65	26-SEP-1993	05:20:33	9555 93291j298.2	1871 65	21-OCT-1993	06:15:27
8894 93242j256.2	1676 45	7-SEP-1993	20:16:57	9175 93263j270.2	1382 65	26-SEP-1993	06:55:39	9559 93291j298.2	5 15	21-OCT-1993	13:36:29
8895 93242j256.2	1676 45	7-SEP-1993	21:51:29	9181 93263j270.2	935 15	26-SEP-1993	16:49:31	9560 93291j298.2	1874 15	21-OCT-1993	14:08:33
8896 93242j256.2	430 45	7-SEP-1993	21:26:01	9182 93263j270.2	1736 15	26-SEP-1993	17:57:23	9561 93291j298.2	1871 15	21-OCT-1993	15:43:11
8899 93242j256.2	974 65	8-SEP-1993	04:32:59	9189 93263j270.2	1257 65	27-SEP-1993	05:15:01	9562 93291j298.2	1836 15	21-OCT-1993	17:17:49
8900 93242j256.2	1678 65	8-SEP-1993	05:44:05	9190 93263j270.2	1749 65	27-SEP-1993	06:33:11	9563 93291j298.2	830 15	21-OCT-1993	18:47:03
8901 93242j256.2	1024 65	8-SEP-1993	07:18:37	9199 93270j277.2	1751 45	27-SEP-1993	20:43:39	9564 93291j298.2	2005 45	21-OCT-1993	20:21:37
8909 93242j256.2	128 45	8-SEP-1993	20:09:29	9200 93270j277.2	1753 45	27-SEP-1993	22:18:07	9575 93291j298.2	2010 15	22-OCT-1993	13:42:41
8910 93242j256.2	1669 45	8-SEP-1993	21:29:13	9201 93270j277.2	593 45	27-SEP-1993	23:52:39	9579 93291j298.2	2009 45	22-OCT-1993	20:01:13
8911 93242j256.2	1045 45	8-SEP-1993	23:03:45	9209 93270j277.2	1070 15	28-SEP-1993	12:49:45	9580 93291j298.2	1905 45	22-OCT-1993	21:37:19
8914 93242j256.2	212 65	9-SEP-1993	04:36:01	9210 93270j277.2	1754 15	28-SEP-1993	14:03:07	9581 93291j298.2	1844 45	22-OCT-1993	23:10:45
8915 93242j256.2	1677 65	9-SEP-1993	05:21:49	9211 93270j277.2	669 15	28-SEP-1993	15:37:37	9582 93291j298.2	1983 45	23-OCT-1993	00:45:45
8916 93242j256.2	1673 65	9-SEP-1993	06:56:19	9214 93270j277.2	1639 45	28-SEP-1993	20:25:29	9583 93291j298.2	1236 45	23-OCT-1993	02:20:45
8921 93242j256.2	572 15	9-SEP-1993	14:49:07	9215 93270j277.2	1761 45	28-SEP-1993	21:56:01	9585 93291j298.2	685 65	23-OCT-1993	06:13:21
8922 93242j256.2	1651 15	9-SEP-1993	16:23:23	9216 93270j277.2	1224 45	28-SEP-1993	23:30:39	9586 93291j298.2	1018 65	23-OCT-1993	07:02:57
8924 93242j256.2	511 45	9-SEP-1993	20:10:39	9224 93270j277.2	2 15	29-SEP-1993	12:52:35	9590 93291j298.2	1439 15	23-OCT-1993	13:4

9722	93298j312_2	1197	65	1-NOV-1993	06:36:07	9869	93312j319_2	2830	45	10-NOV-1993	21:52:39	10011	93319j326_2	199	45	20-NOV-1993	06:39:15
9723	93305j312_2	2840	65	1-NOV-1993	07:35:41	9870	93312j319_2	2237	45	10-NOV-1993	23:27:17	10012	93319j326_2	2070	65	20-NOV-1993	07:27:37
9724	93305j312_2	2259	65	1-NOV-1993	09:10:17	9871	93312j319_2	2839	45	11-NOV-1993	01:01:55	10013	93319j326_2	1367	65	20-NOV-1993	09:48:27
9725	93305j312_2	2819	65	1-NOV-1993	10:44:57	9872	93312j319_2	2253	45	11-NOV-1993	02:36:33	10014	93319j326_2	2157	65	20-NOV-1993	10:33:59
9726	93305j312_2	2257	65	1-NOV-1993	12:19:13	9873	93312j319_2	2839	45	11-NOV-1993	04:11:11	10016	93319j326_2	308	15	20-NOV-1993	14:44:59
9727	93305j312_2	212	65	1-NOV-1993	13:54:13	9874	93312j319_2	1330	45	11-NOV-1993	05:45:47	10019	93319j326_2	819	45	20-NOV-1993	19:34:27
9730	93305j312_2	756	45	1-NOV-1993	19:47:31	9874	93312j319_2	529	65	11-NOV-1993	07:02:49	10020	93319j326_2	2132	45	20-NOV-1993	20:01:45
9731	93305j312_2	2539	45	1-NOV-1993	20:12:43	9875	93312j319_2	2840	65	11-NOV-1993	07:20:25	10021	93319j326_2	1361	45	20-NOV-1993	22:25:39
9732	93305j312_2	2256	45	1-NOV-1993	21:47:21	9876	93312j319_2	2251	65	11-NOV-1993	08:55:03	10022	93319j326_2	2161	45	20-NOV-1993	23:10:59
9733	93305j312_2	2829	45	1-NOV-1993	23:21:59	9877	93312j319_2	2730	65	11-NOV-1993	10:29:41	10023	93319j326_2	1361	45	21-NOV-1993	01:34:53
9734	93305j312_2	2258	45	2-NOV-1993	00:56:35	9878	93312j319_2	2034	65	11-NOV-1993	12:04:19	10024	93319j326_2	2180	45	21-NOV-1993	02:20:15
9735	93305j312_2	2712	45	2-NOV-1993	02:31:13	9879	93312j319_2	1491	15	11-NOV-1993	14:23:53	10025	93319j326_2	1361	45	21-NOV-1993	04:44:09
9736	93305j312_2	2258	45	2-NOV-1993	04:05:51	9880	93312j319_2	666	15	11-NOV-1993	15:13:35	10026	93319j326_2	2161	45	21-NOV-1993	05:29:29
9737	93305j312_2	176	45	2-NOV-1993	05:40:29	9883	93312j319_2	1383	45	11-NOV-1993	20:45:59	10027	93319j326_2	1294	65	21-NOV-1993	07:53:23
9737	93305j312_2	1051	65	2-NOV-1993	06:39:31	9884	93312j319_2	2141	45	11-NOV-1993	21:32:05	10031	93319j326_2	193	15	21-NOV-1993	14:47:59
9738	93305j312_2	2260	65	2-NOV-1993	07:15:07	9885	93312j319_2	1382	45	11-NOV-1993	23:55:17	10032	93319j326_2	1128	15	21-NOV-1993	14:57:15
9739	93305j312_2	475	65	2-NOV-1993	08:50:17	9886	93312j319_2	2124	45	12-NOV-1993	00:41:21	10033	93319j326_2	1361	15	21-NOV-1993	17:21:09
9742	93305j312_2	1395	15	2-NOV-1993	14:02:57	9887	93312j319_2	1383	45	12-NOV-1993	03:04:31	10034	93319j326_2	2156	15	21-NOV-1993	18:06:29
9743	93305j312_2	2839	15	2-NOV-1993	15:08:49	9888	93312j319_2	2137	45	12-NOV-1993	03:50:35	10035	93319j326_2	1334	45	21-NOV-1993	20:30:57
9744	93305j312_2	2259	15	2-NOV-1993	16:43:27	9889	93312j319_2	638	45	12-NOV-1993	06:13:49	10036	93319j326_2	2141	45	21-NOV-1993	20:15:45
9745	93305j312_2	1683	15	2-NOV-1993	18:18:05	9890	93312j319_2	1975	65	12-NOV-1993	07:05:31	10037	93319j326_2	1357	45	21-NOV-1993	23:39:47
9746	93305j312_2	1462	45	2-NOV-1993	20:19:13	9894	93312j319_2	129	15	12-NOV-1993	14:25:33	10038	93319j326_2	1071	45	22-NOV-1993	00:24:59
9747	93305j312_2	2839	45	2-NOV-1993	21:27:21	9895	93312j319_2	1383	15	12-NOV-1993	15:41:33	10042	93319j333_2	677	65	22-NOV-1993	07:33:17
9748	93305j312_2	2257	45	2-NOV-1993	23:01:59	9896	93312j319_2	2134	15	12-NOV-1993	16:27:37	10043	93326j333_2	1360	65	22-NOV-1993	09:07:31
9749	93305j312_2	2829	45	3-NOV-1993	00:36:37	9897	93312j319_2	1382	15	12-NOV-1993	18:50:49	10044	93326j333_2	2170	65	22-NOV-1993	09:52:49
9750	93305j312_2	2256	45	3-NOV-1993	02:11:15	9898	93312j319_2	2	15	12-NOV-1993	19:36:53	10045	93326j333_2	1357	65	22-NOV-1993	12:16:47
9751	93305j312_2	2829	45	3-NOV-1993	03:45:53	9898	93312j319_2	2135	45	12-NOV-1993	19:37:09	10046	93326j333_2	2164	65	22-NOV-1993	13:01:59
9752	93305j312_2	1478	45	3-NOV-1993	05:20:31	9899	93312j319_2	1379	45	12-NOV-1993	22:00:11	10050	93326j333_2	1709	45	22-NOV-1993	19:35:19
9752	93305j312_2	403	65	3-NOV-1993	06:41:43	9900	93312j319_2	2125	45	12-NOV-1993	22:46:09	10051	93326j333_2	1353	45	22-NOV-1993	21:44:39
9753	93305j312_2	2839	65	3-NOV-1993	06:55:09	9905	93312j319_2	1381	65	13-NOV-1993	07:27:55	10052	93326j333_2	469	45	22-NOV-1993	22:29:45
9754	93305j312_2	726	65	3-NOV-1993	08:29:47	9906	93312j319_2	2135	65	13-NOV-1993	08:13:57	10057	93326j333_2	569	65	23-NOV-1993	07:38:33
9757	93305j312_2	1236	15	3-NOV-1993	14:06:47	9907	93312j319_2	1376	65	13-NOV-1993	10:37:09	10058	93326j333_2	2174	65	23-NOV-1993	07:57:29
9758	93305j312_2	2258	15	3-NOV-1993	14:48:19	9908	93312j319_2	2145	65	13-NOV-1993	11:23:11	10059	93326j333_2	1351	65	23-NOV-1993	10:21:43
9759	93305j312_2	2839	15	3-NOV-1993	16:22:57	9909	93312j319_2	135	15	13-NOV-1993	14:27:59	10060	93326j333_2	2178	65	23-NOV-1993	11:06:43
9760	93305j312_2	2260	15	3-NOV-1993	17:57:35	9909	93312j319_2	1242	65	13-NOV-1993	13:46:27	10061	93326j333_2	1350	65	23-NOV-1993	13:30:59
9761	93305j312_2	279	15	3-NOV-1993	19:32:13	9910	93312j319_2	2141	15	13-NOV-1993	14:32:25	10062	93326j333_2	2115	65	23-NOV-1993	14:15:59
9761	93305j312_2	2542	45	3-NOV-1993	19:41:49	9911	93312j319_2	1379	15	13-NOV-1993	16:55:43	10065	93326j333_2	890	45	23-NOV-1993	20:04:49
9762	93305j312_2	1488	45	3-NOV-1993	21:06:51	9912	93312j319_2	2144	15	13-NOV-1993	17:41:41	10066	93326j333_2	2172	45	23-NOV-1993	20:34:29
9768	93305j312_2	1965	65	4-NOV-1993	06:44:23	9913	93312j319_2	1373	45	13-NOV-1993	20:05:03	10067	93326j333_2	1348	45	23-NOV-1993	22:58:49
9769	93305j312_2	2830	65	4-NOV-1993	08:09:17	9914	93312j319_2	2149	45	13-NOV-1993	20:50:55	10068	93326j333_2	2181	45	23-NOV-1993	23:41:43
9770	93305j312_2	1487	65	4-NOV-1993	09:43:55	9915	93312j319_2	1377	45	13-NOV-1993	23:14:19	10069	93326j333_2	1347	45	24-NOV-1993	02:08:05
9772	93305j312_2	608	15	4-NOV-1993	14:07:35	9916	93312j319_2	2148	45	14-NOV-1993	00:00:11	10070	93326j333_2	2177	45	24-NOV-1993	02:52:59
9773	93305j312_2	2122	15	4-NOV-1993	14:27:51	9917	93312j319_2	1366	45	14-NOV-1993	02:23:35	10071	93326j333_2	1346	45	24-NOV-1993	05:17:21
9776	93305j312_2	1241	45	4-NOV-1993	19:42:33	9918	93312j319_2	2145	45	14-NOV-1993	03:09:27	10072	93326j333_2	1743	45	24-NOV-1993	06:02:13
9777	93305j312_2	2839	45	4-NOV-1993	20:46:23	9919	93312j319_2	1376	45	14-NOV-1993	05:32:51	10073	93326j333_2	1342	65	24-NOV-1993	08:26:45
9778	93305j312_2	1950	45	4-NOV-1993	22:21:01	9920	93312j319_2	649	45	14-NOV-1993	06:18:43	10074	93326j333_2	1092	65	24-NOV-1993	09:11:27
9779	93305j312_2	1492	45	4-NOV-1993	23:55:39	9920	93312j319_2	563	65	14-NOV-1993	07:11:25	10077	93326j333_2	798	15	24-NOV-1993	15:03:15
9783	93305j312_2	1764	65	5-NOV-1993	06:50:03	9921	93312j319_2	1378	65	14-NOV-1993	08:42:03	10078	93326j333_2	1358	15	24-NOV-1993	15:29:57
9784	93305j312_2	2086	65	5-NOV-1993	07:48:49	9922	93312j319_2	1991	65	14-NOV-1993	09:27:57	10081	93326j333_2	1333	45	24-NOV-1993	21:03:41
9785	93305j312_2	2257	65	5-NOV-1993	09:23:27	9923	93312j319_2	1377	65	14-NOV-1993	11:51:21	10082	93326j333_2	2185	45	24-NOV-1993	21:48:27
9786	93305j312_2	2225	65	5-NOV-1993	10:58:05	9924	93312j319_2	2148	65	14-NOV-1993	12:37:13	10088	93326j333_2	441	65	25-NOV-1993	08:14:17
9787	93305j312_2	2218	65	5-NOV-1993	12:32:43	9925	93312j319_2	936	65	14-NOV-1993	15:00:37	10089	93326j333_2	1337	65	25-NOV-1993	09:40:53
9791	93305j312_2	1426	45	5-NOV-1993	19:38:23	9925	93312j319_2	433	45	14-NOV-1993	19:52:57	10090	93326j333_2	2184	65	25-NOV-1993	10:25:25
9792	93305j312_2	2243	45	5-NOV-1993	20:25:53	9928	93312j319_2	1374	45	14-NOV-1993	21:19:13	10093	93326j333_2	1337	15	25-NOV-1993	15:59:21
9793	93305j312_2	2840	45	5-NOV-1993	22:00:31	9929	93312j319_2	1210	45	14-NOV-1993	22:04:59	10094	93326j333_2	2188	15	25-NOV-1993	16:43:55
9794	93305j312_2	2213	45	5-NOV-1993	23:35:09	9936	93319j326_2	1333	65	15-NOV-1993	08:00:11	10095	93326j333_2	718	15	25-NOV-1993	19:08:35
9795	93305j312_2	2840	45	6-NOV-1993	01:09:47	9941	93319j326_2	682	15	15-NOV-1993	16:37:59	10095	93326j333_2	4	45	25-NOV-1993	19:35:51
9796	93305j312_2	2253	45	6-NOV-1993	02:44:45	9942	93319j326_2	1562	15	15-NOV-1993	17:00:43	10096	93326j333_2	1563	45	25-NOV-1993	20:13:57
9797	93305j312_2	2575	45	6-NOV-1993	04:19:03	9943	93319j326_2	391	15	15-NOV-1993	19:24:03	10099	93326				

10183 93333j340_2	1082 65	1-DEC-1993	13:56:21	10401 93347j354_2	958 45	15-DEC-1993	21:41:09	10831 94010j017_2	1411 45	13-JAN-1994	03:11:39
10184 93333j340_2	1205 15	1-DEC-1993	15:13:47	10402 93347j354_2	1442 45	15-DEC-1993	22:49:31	10835 94010j017_2	1048 65	13-JAN-1994	09:30:01
10184 93333j340_2	450 65	1-DEC-1993	14:57:21	10403 93347j354_2	965 45	16-DEC-1993	00:50:17	10837 94010j017_2	1359 65	13-JAN-1994	12:39:07
10187 93333j340_2	1083 45	1-DEC-1993	20:14:55	10404 93347j354_2	494 45	16-DEC-1993	01:58:45	10951 94017j024_2	981 45	21-JAN-1994	00:34:29
10188 93333j340_2	1663 45	1-DEC-1993	21:16:13	10408 93347j354_2	788 65	16-DEC-1993	08:38:35	10967 94017j024_2	1452 45	22-JAN-1994	01:32:23
10189 93333j340_2	1080 45	1-DEC-1993	23:24:09	10409 93347j354_2	939 65	16-DEC-1993	10:17:43	10969 94017j024_2	1441 45	22-JAN-1994	04:41:21
10190 93333j340_2	1640 45	2-DEC-1993	00:26:07	10413 93347j354_2	1429 15	16-DEC-1993	16:21:45	10971 94017j024_2	1453 45	22-JAN-1994	07:50:27
10191 93333j340_2	1056 45	2-DEC-1993	02:33:23	10415 93347j354_2	26 45	16-DEC-1993	20:17:23	10973 94017j024_2	293 65	22-JAN-1994	11:05:09
10192 93333j340_2	1674 45	2-DEC-1993	03:34:51	10417 93347j354_2	1734 45	16-DEC-1993	22:30:11	10983 94017j024_2	1438 45	23-JAN-1994	02:45:17
10195 93333j340_2	1058 65	2-DEC-1993	08:51:51	10423 93347j354_2	210 65	17-DEC-1993	08:47:59	10985 94017j024_2	1438 45	23-JAN-1994	05:54:21
10196 93333j340_2	817 65	2-DEC-1993	09:53:33	10431 93347j354_2	1723 45	17-DEC-1993	20:34:43	10987 94017j024_2	388 65	23-JAN-1994	09:38:31
10202 93333j340_2	1224 45	2-DEC-1993	19:34:07	10433 93347j354_2	189 45	17-DEC-1993	23:43:55	10989 94017j024_2	1446 65	23-JAN-1994	12:12:17
10203 93333j340_2	1080 45	2-DEC-1993	21:28:31	10443 93347j354_2	1003 15	18-DEC-1993	15:53:45	10991 94017j024_2	1444 65	23-JAN-1994	15:21:21
10204 93333j340_2	1578 45	2-DEC-1993	22:31:23	10447 93347j354_2	1695 45	18-DEC-1993	21:48:39	10995 94017j024_2	1429 45	23-JAN-1994	21:39:57
10205 93333j340_2	1114 45	3-DEC-1993	00:36:41	10467 93347j354_2	1689 45	20-DEC-1993	05:20:39	11003 94024j031_2	1193 65	24-JAN-1994	10:16:31
10206 93333j340_2	1510 45	3-DEC-1993	01:42:13	10473 93354j361_2	1272 65	20-DEC-1993	14:49:53	11005 94024j031_2	1419 65	24-JAN-1994	13:25:33
10207 93333j340_2	1089 45	3-DEC-1993	03:45:53	10481 93354j361_2	1679 45	21-DEC-1993	03:25:17	11007 94024j031_2	405 65	24-JAN-1994	16:35:15
10208 93333j340_2	1580 45	3-DEC-1993	04:50:01	10483 93354j361_2	1670 45	21-DEC-1993	06:34:25	11011 94024j031_2	614 15	24-JAN-1994	22:55:49
10209 93333j340_2	899 45	3-DEC-1993	06:55:07	10485 93354j361_2	1672 65	21-DEC-1993	09:43:55	11021 94024j031_2	31 65	25-JAN-1994	15:06:05
10210 93333j340_2	1447 65	3-DEC-1993	08:04:11	10491 93354j361_2	359 45	21-DEC-1993	19:55:19	11029 94024j031_2	1538 45	26-JAN-1994	03:10:27
10219 93333j340_2	1005 45	3-DEC-1993	22:41:51	10493 93354j361_2	1675 45	21-DEC-1993	22:20:37	11031 94024j031_2	1535 45	26-JAN-1994	06:19:37
10220 93333j340_2	1160 45	3-DEC-1993	23:46:41	10495 93354j361_2	1674 45	22-DEC-1993	01:29:47	11037 94024j031_2	1532 65	26-JAN-1994	15:46:49
10225 93333j340_2	477 65	4-DEC-1993	08:29:37	10497 93354j361_2	1671 45	22-DEC-1993	04:38:59	11039 94024j031_2	1470 15	26-JAN-1994	08:57:57
10226 93333j340_2	1549 65	4-DEC-1993	09:13:57	10499 93354j361_2	383 45	22-DEC-1993	07:48:11	11041 94024j031_2	1525 15	26-JAN-1994	22:05:07
10227 93333j340_2	1088 65	4-DEC-1993	11:17:53	10503 93354j361_2	1399 65	22-DEC-1993	14:06:33	11049 94024j031_2	1529 65	27-JAN-1994	10:41:19
10228 93333j340_2	1544 65	4-DEC-1993	12:23:17	10507 93354j361_2	1669 45	22-DEC-1993	20:25:05	11051 94024j031_2	1530 65	27-JAN-1994	13:50:25
10229 93333j340_2	1086 65	4-DEC-1993	14:27:07	10517 93354j361_2	361 65	23-DEC-1993	12:54:35	11057 94024j031_2	834 15	27-JAN-1994	23:17:15
10230 93333j340_2	1067 15	4-DEC-1993	15:48:59	10519 93354j361_2	774 65	23-DEC-1993	15:20:27	11067 94024j031_2	873 65	28-JAN-1994	15:24:27
10231 93333j340_2	1096 15	4-DEC-1993	17:36:25	10523 93354j361_2	1647 45	23-DEC-1993	21:39:11	11069 94024j031_2	1519 15	28-JAN-1994	18:11:25
10232 93333j340_2	1169 15	4-DEC-1993	18:41:49	10525 93354j361_2	1671 45	24-DEC-1993	00:47:59	11071 94024j031_2	741 15	28-JAN-1994	21:20:25
10233 93333j340_2	1084 45	4-DEC-1993	20:45:55	10527 93354j361_2	1670 45	24-DEC-1993	03:57:11	11073 94024j031_2	1525 45	29-JAN-1994	00:29:57
10234 93333j340_2	1553 45	4-DEC-1993	21:51:19	10529 93354j361_2	1155 45	24-DEC-1993	07:06:35	11075 94024j031_2	1529 45	29-JAN-1994	03:38:51
10235 93333j340_2	1080 45	4-DEC-1993	23:54:53	10531 93354j361_2	1648 65	24-DEC-1993	10:15:43	11077 94024j031_2	1531 45	29-JAN-1994	06:47:51
10236 93333j340_2	1533 45	5-DEC-1993	01:00:35	10551 93354j361_2	373 15	25-DEC-1993	17:47:25	11079 94024j031_2	1363 65	29-JAN-1994	09:07:27
10237 93333j340_2	1073 45	5-DEC-1993	03:04:15	10553 93354j361_2	941 45	25-DEC-1993	20:56:51	11081 94024j031_2	1594 65	29-JAN-1994	13:02:37
10238 93333j340_2	1060 45	5-DEC-1993	04:09:53	10555 93354j361_2	1584 45	26-DEC-1993	00:08:31	11089 94024j031_2	1552 45	30-JAN-1994	01:40:15
10241 93333j340_2	1075 65	5-DEC-1993	09:22:35	10557 93354j361_2	1629 45	26-DEC-1993	03:15:31	11091 94024j031_2	1530 45	30-JAN-1994	04:48:59
10242 93333j340_2	1510 65	5-DEC-1993	10:29:01	10559 93354j361_2	1641 45	26-DEC-1993	06:24:25	11093 94024j031_2	200 45	30-JAN-1994	08:00:01
10243 93333j340_2	1075 65	5-DEC-1993	12:31:45	10561 93354j361_2	1615 65	26-DEC-1993	09:34:33	11095 94024j031_2	1622 65	30-JAN-1994	11:06:07
10244 93333j340_2	1063 65	5-DEC-1993	13:49:37	10563 93354j361_2	1643 65	26-DEC-1993	12:42:47	11097 94024j031_2	1624 65	30-JAN-1994	14:15:07
10248 93333j340_2	1532 45	5-DEC-1993	19:56:23	10569 93354j361_2	1634 45	26-DEC-1993	22:10:33	11109 94031j038_2	1202 65	31-JAN-1994	09:22:23
10249 93333j340_2	1063 45	5-DEC-1993	22:00:09	10571 93354j361_2	1637 45	27-DEC-1993	01:19:37	11111 94031j038_2	1573 65	31-JAN-1994	12:19:15
10256 93340j347_2	1532 65	6-DEC-1993	08:33:33	10573 93354j361_2	1637 45	27-DEC-1993	04:28:47	11113 94031j038_2	1546 65	31-JAN-1994	15:28:49
10264 93340j347_2	1500 45	6-DEC-1993	21:10:51	10575 93361j003_2	979 45	27-DEC-1993	07:37:55	11117 94031j038_2	1516 45	31-JAN-1994	21:48:17
10265 93340j347_2	912 45	6-DEC-1993	23:14:17	10577 93361j003_2	1636 65	27-DEC-1993	10:47:13	11125 94031j038_2	1605 65	1-FEB-1994	10:22:17
10271 93340j347_2	818 65	7-DEC-1993	08:49:43	10579 93361j003_2	1637 65	27-DEC-1993	13:56:23	11129 94031j038_2	1434 15	1-FEB-1994	16:45:21
10272 93340j347_2	1492 65	7-DEC-1993	09:48:43	10581 93361j003_2	1636 15	27-DEC-1993	17:05:25	11131 94031j038_2	1516 15	1-FEB-1994	19:50:31
10275 93340j347_2	216 15	7-DEC-1993	15:27:19	10583 93361j003_2	1641 45	27-DEC-1993	20:14:39	11133 94031j038_2	1543 15	1-FEB-1994	22:57:55
10276 93340j347_2	1475 15	7-DEC-1993	16:06:57	10585 93361j003_2	1633 45	27-DEC-1993	23:23:55	11135 94031j038_2	705 45	2-FEB-1994	02:24:49
10277 93340j347_2	1057 15	7-DEC-1993	18:09:07	10599 93361j003_2	1567 45	28-DEC-1993	21:30:17	11137 94031j038_2	1186 45	2-FEB-1994	05:30:37
10278 93340j347_2	877 15	7-DEC-1993	19:16:11	10601 93361j003_2	1646 45	29-DEC-1993	00:37:15	11141 94031j038_2	1608 65	2-FEB-1994	11:34:39
10279 93340j347_2	1035 45	7-DEC-1993	21:18:59	10607 93361j003_2	1627 65	29-DEC-1993	10:04:55	11143 94031j038_2	1607 65	2-FEB-1994	14:43:39
10280 93340j347_2	1469 45	7-DEC-1993	22:25:37	10609 93361j003_2	1626 65	29-DEC-1993	13:14:03	11149 94031j038_2	977 15	3-FEB-1994	00:11:29
10286 93340j347_2	691 65	8-DEC-1993	08:17:59	10611 93361j003_2	1636 15	29-DEC-1993	16:23:13	11157 94031j038_2	247 65	3-FEB-1994	13:32:23
10291 93340j347_2	1053 15	8-DEC-1993	16:13:13	10617 93361j003_2	1613 45	30-DEC-1993	01:51:07	11159 94031j038_2	1465 65	3-FEB-1994	15:59:59
10292 93340j347_2	1484 15	8-DEC-1993	17:20:47	10619 93361j003_2	1621 45	30-DEC-1993	05:00:01	11163 94031j038_2	831 45	3-FEB-1994	22:21:23
10293 93340j347_2	538 15	8-DEC-1993	19:22:23	10621 93361j003_2	502 45	30-DEC-1993	08:09:07	11165 94031j038_2	1037 45	4-FEB-1994	01:42:09
10294 93340j347_2	1217 45	8-DEC-1993	20:34:01	10625 93361j003_2	1617 65	30-DEC-1993	14:27:39	11167 94031j038_2	1557 45	4-FEB-1994	04:33:51
10295 93340j347_2	1033 45	8-DEC-1993	22:32:29	10629 93361j003_2	1602 45	30-DEC-1993	20:46:55	11169 94031j038_2	690 45	4-FEB-1994	07:42:45
10296 93340j347_2	1195 45	8-DEC-1993	23:40:09	10631 93361j003_2	1622 45	30-DEC-1993	23:54:59	11171 94031j038_2	1528 65	4-FEB-1994	10:51:53
10302 93340j347_2	1459 65	9-DEC-1993	09:07:25	10633 93361j003_2	1620 45	31-DEC-1993	03:04:09	11173 94031j038_2	1163 65	4-FEB-1994	14:11:53
10303 93340j347_2	1056 65	9-DEC-1993	11:08:27	10637 93361j003_2	1619 65	31-DEC-1993	09:22:35	11179 94031j038_2	1620 45	4-FEB-1994	23:25:59
10304 93340j347_2	1469 65	9-DEC-1993	12:16:57	10657 93361j003_2	91 15	1-JAN-1994	17:00:35	11181 94031j038_2	1633 45	5-FEB-1994	02:34:35
10305 93340j347_2	1050 65	9-DEC-1993	14:17:47	10659 93361j003_2	1419 45	1-JAN-1994	20:10:41	11183 94031j038_2	1635 45	5-FEB-1994	05:43:35
10306 93340j347_2	925 15	9-DEC-1993	15:44:21	10661 93361j003_2	1616 45	1-JAN-1994	23:12:35	11185 94031j038_2	191 65	5-FEB-1994	09:40:45
10307 93340j347_2	1000 15	9-DEC-1993	17:28:41	10663 93361j003_2	1614 45	2-JAN-1994	02:21:45	11187 94031j038_2	1607 65	5-FEB-1994	12:01:39
10308 93340j347_2	1465 15	9-DEC-1993	18:35:09	10665 93361j003_2	1614 45	2-JAN-1994	05:30:51	11189 94031j038_2	1605 65</		

11347 94045j052\_2 1660 15 16-FEB-1994 00:03:31  
11351 94045j052\_2 679 45 16-FEB-1994 06:48:53  
11361 94045j052\_2 1663 15 16-FEB-1994 22:06:35  
11363 94045j052\_2 143 15 17-FEB-1994 01:16:09  
11373 94045j052\_2 1666 15 17-FEB-1994 17:00:41  
11375 94045j052\_2 1667 15 17-FEB-1994 20:09:49  
11377 94045j052\_2 1669 45 17-FEB-1994 23:18:43  
11379 94045j052\_2 1634 45 18-FEB-1994 02:27:35  
11381 94045j052\_2 1674 45 18-FEB-1994 05:36:31  
11391 94045j052\_2 866 15 18-FEB-1994 21:46:05  
11393 94045j052\_2 1578 15 19-FEB-1994 00:31:27  
11397 94045j052\_2 1681 45 19-FEB-1994 06:48:29  
11403 94045j052\_2 1348 15 19-FEB-1994 16:26:47  
11405 94045j052\_2 1670 15 19-FEB-1994 19:24:29  
11407 94045j052\_2 1685 45 19-FEB-1994 22:33:31  
11409 94045j052\_2 1671 45 20-FEB-1994 01:42:31  
11411 94045j052\_2 1690 45 20-FEB-1994 04:51:25  
11419 94045j052\_2 1682 15 20-FEB-1994 17:27:47  
11421 94045j052\_2 1683 15 20-FEB-1994 20:36:43  
11423 94045j052\_2 1686 15 20-FEB-1994 23:45:39  
11427 94045j052\_2 1696 45 21-FEB-1994 06:03:21  
11435 94052j059\_2 1687 15 21-FEB-1994 18:39:39  
11437 94052j059\_2 1687 15 21-FEB-1994 21:48:13  
11439 94052j059\_2 1112 15 22-FEB-1994 00:57:09  
11441 94052j059\_2 1705 45 22-FEB-1994 04:06:11  
11443 94052j059\_2 1694 45 22-FEB-1994 07:15:37  
11445 94052j059\_2 1698 65 22-FEB-1994 10:24:21  
11447 94052j059\_2 1709 65 22-FEB-1994 13:33:09  
11449 94052j059\_2 1709 65 22-FEB-1994 16:42:05  
11453 94052j059\_2 960 15 22-FEB-1994 23:24:53  
11465 94052j059\_2 1693 15 23-FEB-1994 17:54:49  
11467 94052j059\_2 1701 15 23-FEB-1994 21:03:13  
11469 94052j059\_2 1716 15 24-FEB-1994 00:11:59  
11475 94052j059\_2 1725 65 24-FEB-1994 09:38:53  
11477 94052j059\_2 1716 65 24-FEB-1994 12:47:53  
11479 94052j059\_2 1730 65 24-FEB-1994 15:56:47  
11481 94052j059\_2 1751 15 24-FEB-1994 19:03:33  
11483 94052j059\_2 1750 15 24-FEB-1994 22:12:17  
11485 94052j059\_2 405 15 25-FEB-1994 01:21:33  
11491 94052j059\_2 1755 65 25-FEB-1994 10:47:47  
11493 94052j059\_2 1735 65 25-FEB-1994 13:57:21  
11495 94052j059\_2 1395 65 25-FEB-1994 17:05:45  
11499 94052j059\_2 1767 15 25-FEB-1994 23:23:39  
11507 94052j059\_2 472 65 26-FEB-1994 12:43:17  
11509 94052j059\_2 1791 65 26-FEB-1994 15:08:15  
11511 94052j059\_2 1793 15 26-FEB-1994 18:17:13  
11513 94052j059\_2 1786 15 26-FEB-1994 21:26:05  
11515 94052j059\_2 1782 15 27-FEB-1994 00:35:01  
11523 94052j059\_2 1650 65 27-FEB-1994 13:15:03  
11525 94052j059\_2 404 15 27-FEB-1994 16:21:33  
11527 94052j059\_2 1774 15 27-FEB-1994 19:29:23  
11529 94052j059\_2 1804 15 27-FEB-1994 22:37:25  
11537 94059j066\_2 1793 65 28-FEB-1994 11:13:27  
11539 94059j066\_2 1800 65 28-FEB-1994 14:22:15  
11541 94059j066\_2 137 15 28-FEB-1994 18:27:01  
11543 94059j066\_2 1800 15 28-FEB-1994 20:40:19  
11545 94059j066\_2 1798 15 28-FEB-1994 23:49:31  
11553 94059j066\_2 1784 65 1-MAR-1994 12:25:27  
11555 94059j066\_2 1810 65 1-MAR-1994 15:33:43  
11557 94059j066\_2 1822 15 1-MAR-1994 18:43:11  
11563 94059j066\_2 1810 45 1-MAR-1994 04:10:17  
11565 94059j066\_2 1821 45 2-MAR-1994 07:19:11  
11571 94059j066\_2 550 65 2-MAR-1994 10:28:07  
11573 94059j066\_2 1846 15 2-MAR-1994 16:45:17  
11575 94059j066\_2 1809 45 2-MAR-1994 23:04:31  
11577 94059j066\_2 1831 45 3-MAR-1994 02:12:57  
11579 94059j066\_2 1824 45 3-MAR-1994 05:21:47  
11583 94059j066\_2 1331 65 3-MAR-1994 11:55:51  
11585 94059j066\_2 1818 65 3-MAR-1994 14:48:33  
11587 94059j066\_2 1804 15 3-MAR-1994 17:58:55  
11589 94059j066\_2 1839 15 3-MAR-1994 21:06:23  
11591 94059j066\_2 1850 15 4-MAR-1994 00:15:21  
11593 94059j066\_2 979 45 4-MAR-1994 03:53:25  
11595 94059j066\_2 1815 45 4-MAR-1994 06:32:53  
11597 94059j066\_2 1841 65 4-MAR-1994 09:41:59  
11599 94059j066\_2 1846 65 4-MAR-1994 12:50:53  
11601 94059j066\_2 1849 65 4-MAR-1994 15:59:49  
11603 94059j066\_2 1102 15 4-MAR-1994 19:08:43  
11615 94059j066\_2 774 65 5-MAR-1994 14:03:51  
11617 94059j066\_2 1907 15 5-MAR-1994 17:10:37  
11619 94059j066\_2 1917 15 5-MAR-1994 20:20:21  
11621 94059j066\_2 1937 15 5-MAR-1994 23:29:07  
11623 94059j066\_2 1940 45 6-MAR-1994 02:37:59  
11629 94059j066\_2 1566 65 6-MAR-1994 12:17:43  
11631 94059j066\_2 1919 65 6-MAR-1994 15:14:11  
11633 94059j066\_2 1953 15 6-MAR-1994 18:23:43  
11635 94059j066\_2 1953 15 6-MAR-1994 21:32:31  
11637 94059j066\_2 1962 15 7-MAR-1994 00:41:25  
11643 94066j073\_2 2000 65 7-MAR-1994 10:08:09  
11645 94066j073\_2 1975 65 7-MAR-1994 13:17:29  
11647 94066j073\_2 1950 15 7-MAR-1994 16:26:59  
11649 94066j073\_2 1974 15 7-MAR-1994 19:35:53  
11651 94066j073\_2 1488 15 7-MAR-1994 22:44:49  
11653 94066j073\_2 1039 45 8-MAR-1994 01:53:51  
11655 94066j073\_2 1749 45 8-MAR-1994 05:09:07  
11657 94066j073\_2 462 45 8-MAR-1994 08:12:03  
11663 94066j073\_2 1993 15 8-MAR-1994 17:37:57  
11669 94066j073\_2 2000 45 9-MAR-1994 03:05:11  
11671 94066j073\_2 2017 45 9-MAR-1994 06:13:25  
11677 94066j073\_2 1089 15 9-MAR-1994 16:11:51  
11679 94066j073\_2 2049 15 9-MAR-1994 18:48:45  
11681 94066j073\_2 2085 15 9-MAR-1994 21:56:47  
11683 94066j073\_2 2083 45 10-MAR-1994 01:05:35  
11685 94066j073\_2 2100 45 10-MAR-1994 04:14:23  
11687 94066j073\_2 2097 45 10-MAR-1994 07:23:27  
11693 94066j073\_2 1707 15 10-MAR-1994 16:52:41  
11695 94066j073\_2 2102 15 10-MAR-1994 19:57:59  
11697 94066j073\_2 2132 15 10-MAR-1994 23:06:15  
11699 94066j073\_2 2132 15 10-MAR-1994 23:06:15  
11701 94066j073\_2 2116 45 11-MAR-1994 02:30:51  
11709 94066j073\_2 2155 15 11-MAR-1994 05:22:57  
11715 94066j073\_2 2184 45 12-MAR-1994 03:21:05  
11717 94066j073\_2 2204 45 12-MAR-1994 06:29:21  
11723 94066j073\_2 1499 15 12-MAR-1994 16:06:41  
11725 94066j073\_2 2249 15 12-MAR-1994 19:02:27  
11727 94066j073\_2 2232 15 12-MAR-1994 22:10:51  
11729 94066j073\_2 1542 15 13-MAR-1994 01:19:07  
11731 94066j073\_2 2277 45 13-MAR-1994 04:27:21  
11733 94066j073\_2 1331 45 13-MAR-1994 07:35:35  
11739 94066j073\_2 2327 15 13-MAR-1994 17:00:19  
11741 94066j073\_2 2323 15 13-MAR-1994 20:09:03  
11743 94066j073\_2 2354 45 13-MAR-1994 23:16:41  
11745 94066j073\_2 2372 45 14-MAR-1994 02:24:49  
11757 94073j080\_2 1691 15 14-MAR-1994 21:39:23  
11758 94073j080\_2 20 15 14-MAR-1994 22:35:45  
11759 94073j080\_2 2461 15 15-MAR-1994 00:21:13  
11760 94073j080\_2 30 15 15-MAR-1994 01:44:13  
11760 94073j080\_2 234 45 15-MAR-1994 03:10:39  
11761 94073j080\_2 2461 45 15-MAR-1994 03:18:25  
11762 94073j080\_2 268 45 15-MAR-1994 04:52:39  
11763 94073j080\_2 2515 45 15-MAR-1994 06:26:53  
11764 94073j080\_2 53 45 15-MAR-1994 08:01:05  
11769 94073j080\_2 2348 15 15-MAR-1994 16:07:47  
11770 94073j080\_2 395 15 15-MAR-1994 17:26:25  
11771 94073j080\_2 920 15 15-MAR-1994 19:00:39  
11773 94073j080\_2 1065 45 15-MAR-1994 23:07:45  
11774 94073j080\_2 398 45 15-MAR-1994 23:43:19  
11775 94073j080\_2 2826 45 16-MAR-1994 01:17:31  
11776 94073j080\_2 401 45 16-MAR-1994 02:51:45  
11777 94073j080\_2 1481 45 16-MAR-1994 04:25:59  
11781 94073j080\_2 2329 65 16-MAR-1994 10:59:23  
11782 94073j080\_2 148 65 16-MAR-1994 12:17:03  
11783 94073j080\_2 1973 65 16-MAR-1994 14:19:45  
11784 94073j080\_2 397 65 16-MAR-1994 15:25:31  
11785 94073j080\_2 2821 65 16-MAR-1994 16:59:43  
11786 94073j080\_2 145 65 16-MAR-1994 18:33:57  
11787 94073j080\_2 246 65 17-MAR-1994 08:33:43  
11795 94073j080\_2 2827 65 17-MAR-1994 08:41:53  
11796 94073j080\_2 396 65 17-MAR-1994 10:16:07  
11797 94073j080\_2 2826 65 17-MAR-1994 11:50:21  
11798 94073j080\_2 306 65 17-MAR-1994 13:24:33  
11799 94073j080\_2 2816 65 17-MAR-1994 14:58:47  
11800 94073j080\_2 410 65 17-MAR-1994 16:32:59  
11801 94073j080\_2 1193 65 17-MAR-1994 18:07:13  
11802 94073j080\_2 167 15 17-MAR-1994 21:10:05  
11803 94073j080\_2 2826 15 17-MAR-1994 21:15:39  
11804 94073j080\_2 394 15 17-MAR-1994 22:49:51  
11805 94073j080\_2 2825 15 18-MAR-1994 00:24:03  
11806 94073j080\_2 233 15 18-MAR-1994 01:58:17  
11809 94073j080\_2 2424 45 18-MAR-1994 06:54:19  
11810 94073j080\_2 44 45 18-MAR-1994 08:15:09  
11811 94073j080\_2 1459 65 18-MAR-1994 10:34:53  
11812 94073j080\_2 338 65 18-MAR-1994 11:23:35  
11813 94073j080\_2 2825 65 18-MAR-1994 12:57:47  
11814 94073j080\_2 384 65 18-MAR-1994 14:32:01  
11815 94073j080\_2 2826 65 18-MAR-1994 16:06:13  
11816 94073j080\_2 233 65 18-MAR-1994 17:40:27  
11819 94073j080\_2 1933 45 18-MAR-1994 22:52:41  
11820 94073j080\_2 408 45 18-MAR-1994 23:57:17  
11821 94073j080\_2 2817 45 19-MAR-1994 01:31:31  
11822 94073j080\_2 383 45 19-MAR-1994 03:05:43  
11823 94073j080\_2 2826 45 19-MAR-1994 04:39:57  
11824 94073j080\_2 396 45 19-MAR-1994 06:14:09  
11825 94073j080\_2 726 45 19-MAR-1994 07:48:23  
11826 94073j080\_2 158 65 19-MAR-1994 10:51:33  
11827 94073j080\_2 2826 65 19-MAR-1994 10:56:47  
11828 94073j080\_2 412 65 19-MAR-1994 12:31:01  
11829 94073j080\_2 2825 65 19-MAR-1994 14:05:13  
11830 94073j080\_2 375 65 19-MAR-1994 15:39:27  
11831 94073j080\_2 2 65 19-MAR-1994 17:14:53  
11834 94073j080\_2 93 45 19-MAR-1994 23:27:25  
11835 94073j080\_2 2826 45 19-MAR-1994 23:30:31  
11836 94073j080\_2 413 45 20-MAR-1994 01:04:43  
11837 94073j080\_2 2825 45 20-MAR-1994 02:38:57  
11838 94073j080\_2 226 45 20-MAR-1994 04:13:09  
11848 94073j080\_2 169 15 20-MAR-1994 21:23:53  
11849 94073j080\_2 2826 15 20-MAR-1994 21:29:29  
11850 94073j080\_2 228 15 20-MAR-1994 23:03:43  
11851 94073j080\_2 81 45 21-MAR-1994 00:35:15  
11852 94073j080\_2 2825 45 21-MAR-1994 00:37:55  
11853 94073j080\_2 231 45 21-MAR-1994 02:12:09  
11860 94080j087\_2 99 15 21-MAR-1994 16:16:37  
11861 94080j087\_2 2825 15 21-MAR-1994 16:19:55  
11862 94080j087\_2 391 15 21-MAR-1994 17:54:07  
11863 94080j087\_2 532 15 21-MAR-1994 19:28:21  
11865 94080j087\_2 1344 15 21-MAR-1994 23:25:59  
11866 94080j087\_2 232 15 22-MAR-1994 00:10:59  
11869 94080j087\_2 1963 45 22-MAR-1994 05:22:21  
11870 94080j087\_2 391 45 22-MAR-1994 06:27:49  
11871 94080j087\_2 318 45 22-MAR-1994 08:02:03  
11872 94080j087\_2 138 15 22-MAR-1994 17:22:45  
11873 94080j087\_2 2825 15 22-MAR-1994 17:27:19  
11874 94080j087\_2 365 15 22-MAR-1994 19:01:31  
11875 94080j087\_2 2825 15 22-MAR-1994 20:35:45  
11876 94080j087\_2 363 15 22-MAR-1994 22:09:57  
11877 94080j087\_2 2821 15 22-MAR-1994 23:44:11  
11878 94080j087\_2 230 15 23-MAR-1994 01:18:23  
11880 94080j087\_2 185 45 23-MAR-1994 02:46:27  
11881 94080j087\_2 2826 45 23-MAR-1994 02:52:35  
11882 94080j087\_2 416 45 23-MAR-1994 04:26:49  
11883 94080j087\_2 2816 45 23-MAR-1994 06:01:01  
11884 94080j087\_2 227 45 23-MAR-1994 07:35:15  
11885 94080j087\_2 1363 45 24-MAR-1994 01:40:19  
11886 94080j087\_2 388 45 24-MAR-1994 02:25:47  
11887 94080j087\_2 2826 45 24-MAR-1994 04:00:01  
11888 94080j087\_2 400 45 24-MAR-1994 05:34:13  
11901 94080j087\_2 1861 45 24-MAR-1994 07:08:27  
11908 94080j087\_2 60 15 24-MAR-1994 19:40:09  
11909 94080j087\_2 2826 15 24-MAR-1994 19:42:09  
11910 94080j087\_2 339 15 24-MAR-1994 21:16:21  
11911 94080j087\_2 2816 15 24-MAR-1994 22:50:35  
11912 94080j087\_2 375 15 25-MAR-1994 00:24:47  
11913 94080j087\_2 1103 15 25-MAR-1994 01:51:01  
11915 94080j087\_2 2634 45 25-MAR-1994 05:13:47  
11916 94080j087\_2 226 45 25-MAR-1994 06:41:39  
11922 94080j087\_2 56 15 25-MAR-1994 17:38:31  
11923 94080j087\_2 2826 15 25-MAR-1994 17:41:09  
11924 94080j087\_2 414 15 25-MAR-1994 19:15:21  
11925 94080j087\_2 2825 15 25-MAR-1994 20:49:35  
11926 94080j087\_2 224 15 25-MAR-1994 22:23:47  
11927 94080j087\_2 2197 45 26-MAR-1994 00:18:35  
11928 94080j087\_2 399 45 26-MAR-1994 01:32:13  
11929 94080j087\_2 2825 45 26-MAR-1994 03:06:25  
11930 94080j087\_2 300 45 26-MAR-1994 04:40:39  
11931 94080j087\_2 2821 45 26-MAR-1994 06:14:51  
11932 94080j087\_2 224 45 26-MAR-1994 07:49:05  
11938 94080j087\_2 177 15 26-MAR-1994 18:42:41  
11939 94080j087\_2 2824 15 26-MAR-1994 18:48:35  
11940 94080j087\_2 415 15 26-MAR-1994 20:22:47  
11941 94080j087\_2 2826 15 26-MAR-1994 21:56:59  
11942 94080j087\_2 412 15 26-MAR-1994 23:31:13  
11943 94080j087\_2 2826 15 27-MAR-1994 01:05:25  
11944 94080j087\_2 17 15 27-MAR-1994 02:39:39  
11945 94080j087\_2 188 45 27-MAR-1994 04:07:37  
11946 94080j087\_2 2822 45 27-MAR-1994 04:13:51  
11947 94080j087\_2 405 45 27-MAR-1994 05:08:03  
11948 94080j087\_2 1335 45 27-MAR-1994 07:22:17  
11952 94080j087\_2 175 15 27-MAR-1994 16:41:31  
11953 94080j087\_2 2825 15 27-MAR-1994 16:47:33  
11954 94080j087\_2 346 15 27-MAR-1994 18:21:47  
11955 94080j087\_2 2826 15 27-MAR-1994 19:55:59  
11956 94080j087\_2 387 15 27-MAR-1994 21:30:13  
11957 94080j087\_2 2693 15 27-MAR-1994 23:04:25  
11958 94080j087\_2 298 15 28-MAR-1994 00:41:49  
11959 94080j087\_2 814 15 28-MAR-1994 02:12:45  
11964 94087j094\_2 130 15 29-MAR-1994 18:57:55  
11965 94087j094\_2 2825 15 29-MAR-1994 19:02:15  
11966 94087j094\_2 256 15 29-MAR-1994 20:36:27  
11969 94087j094\_2 2483 15 30-MAR-1994 01:23:55  
11991 94087j094\_2 626 45 30-MAR-1994 05:40:49  
11992 94087j094\_2 392 45 30-MAR-1994 06:01:45  
11993 94087j094\_2 886 45 30-MAR-1994 07:35:57  
11998 94087j094\_2 155 15 30-MAR-1994 16:55:41  
11999 94087j094\_2 2825 15 30-MAR-1994 17:01:15  
12000 94087j094\_2 392 15 30-MAR-1994 18:35:27  
12001 94087j094\_2 2826 15 30-MAR-1994 20:09:41  
12002 94087j094\_2 394 15 30-MAR-1994 21:43:53  
12003 94087j094\_2 2825 15 30-MAR-1994 23:18:07  
12004 94087j094\_2 397 15 31-MAR-1994 00:52:19  
12005 94087j094\_2 1009 15 31-MAR-1994 02:26:33  
12006 94087j094\_2 155 45 31-MAR-1994 05:29:27  
12007 94087j094\_2 2820 45 31-MAR-1994 05:34:59



12073 94094j101_2	2166	65	4-APR-1994	13:35:07	12197 94101j108_2	109	15	12-APR-1994	15:56:55	12344 94108j115_2	857	45	22-APR-1994	03:20:33
12074 94094j101_2	1179	65	4-APR-1994	14:47:19	12198 94101j108_2	1720	15	12-APR-1994	16:42:51	12345 94108j115_2	1555	45	22-APR-1994	04:30:41
12075 94094j101_2	1543	15	4-APR-1994	16:42:17	12199 94101j108_2	98	15	12-APR-1994	19:04:15	12346 94108j115_2	1801	45	22-APR-1994	05:54:57
12076 94094j101_2	315	15	4-APR-1994	18:14:21	12200 94101j108_2	1711	15	12-APR-1994	19:49:05	12347 94108j115_2	832	45	22-APR-1994	07:27:21
12077 94094j101_2	1517	15	4-APR-1994	19:51:43	12201 94101j108_2	104	15	12-APR-1994	22:10:53	12348 94108j115_2	1609	65	22-APR-1994	09:07:15
12078 94094j101_2	73	15	4-APR-1994	21:22:39	12202 94101j108_2	1685	15	12-APR-1994	22:56:03	12349 94108j115_2	1827	65	22-APR-1994	10:32:55
12079 94094j101_2	2153	15	4-APR-1994	23:02:07	12203 94101j108_2	231	15	13-APR-1994	01:17:29	12350 94108j115_2	1821	65	22-APR-1994	12:05:59
12080 94094j101_2	435	15	5-APR-1994	00:13:53	12204 94101j108_2	2193	15	13-APR-1994	01:45:01	12351 94108j115_2	1823	65	22-APR-1994	13:38:55
12081 94094j101_2	1607	15	5-APR-1994	02:10:15	12205 94101j108_2	225	45	13-APR-1994	04:23:33	12352 94108j115_2	1670	65	22-APR-1994	15:11:55
12082 94094j101_2	123	65	5-APR-1994	09:37:37	12206 94101j108_2	2163	45	13-APR-1994	04:51:43	12353 94108j115_2	1817	65	22-APR-1994	16:44:55
12083 94094j101_2	1157	65	5-APR-1994	09:41:43	12207 94101j108_2	358	65	13-APR-1994	10:35:19	12354 94108j115_2	1836	65	22-APR-1994	18:17:45
12084 94094j101_2	2247	65	5-APR-1994	11:36:07	12210 94101j108_2	2154	65	13-APR-1994	11:03:45	12355 94108j115_2	907	15	22-APR-1994	20:21:11
12085 94094j101_2	1154	65	5-APR-1994	12:50:59	12211 94101j108_2	224	65	13-APR-1994	13:41:11	12356 94108j115_2	476	65	22-APR-1994	19:50:45
12086 94094j101_2	850	65	5-APR-1994	15:31:51	12212 94101j108_2	1772	65	13-APR-1994	14:22:25	12357 94108j115_2	1721	15	22-APR-1994	21:27:33
12087 94094j101_2	1166	65	5-APR-1994	16:00:09	12213 94101j108_2	222	65	13-APR-1994	16:47:03	12358 94108j115_2	1834	15	22-APR-1994	22:56:45
12088 94094j101_2	728	65	5-APR-1994	18:44:39	12214 94101j108_2	2128	65	13-APR-1994	17:16:29	12359 94108j115_2	1833	15	23-APR-1994	00:29:43
12089 94094j101_2	478	65	5-APR-1994	19:08:55	12216 94101j108_2	2106	15	13-APR-1994	20:22:47	12360 94108j115_2	1829	15	23-APR-1994	02:02:39
12090 94094j101_2	897	15	5-APR-1994	21:05:59	12217 94101j108_2	249	15	13-APR-1994	22:58:41	12361 94108j115_2	1532	45	23-APR-1994	03:45:35
12091 94094j101_2	1218	15	5-APR-1994	22:17:15	12218 94101j108_2	2008	15	13-APR-1994	23:31:13	12362 94108j115_2	1830	45	23-APR-1994	05:08:37
12092 94094j101_2	2106	15	6-APR-1994	00:15:05	12219 94101j108_2	241	45	14-APR-1994	02:04:45	12363 94108j115_2	1828	45	23-APR-1994	06:41:31
12093 94094j101_2	1213	45	6-APR-1994	01:25:15	12220 94101j108_2	2112	45	14-APR-1994	02:35:23	12364 94108j115_2	1593	65	23-APR-1994	08:21:53
12094 94094j101_2	1219	45	6-APR-1994	03:22:39	12221 94101j108_2	243	45	14-APR-1994	05:10:39	12365 94108j115_2	1808	65	23-APR-1994	09:47:39
12095 94094j101_2	1213	45	6-APR-1994	04:33:15	12222 94101j108_2	2105	45	14-APR-1994	05:41:37	12366 94108j115_2	1808	65	23-APR-1994	11:20:37
12096 94094j101_2	1213	45	6-APR-1994	06:29:09	12223 94101j108_2	1600	65	14-APR-1994	09:03:55	12367 94108j115_2	1807	65	23-APR-1994	12:53:33
12097 94094j101_2	2164	45	6-APR-1994	07:41:17	12224 94101j108_2	241	65	14-APR-1994	11:22:15	12368 94108j115_2	1803	65	23-APR-1994	14:26:33
12098 94094j101_2	414	45	6-APR-1994	09:38:29	12225 94101j108_2	2088	65	14-APR-1994	11:53:37	12369 94108j115_2	1820	15	23-APR-1994	15:59:33
12099 94094j101_2	2125	65	6-APR-1994	10:49:17	12226 94101j108_2	262	65	14-APR-1994	14:28:07	12370 94108j115_2	1811	15	23-APR-1994	17:32:29
12100 94094j101_2	1213	65	6-APR-1994	12:45:07	12227 94101j108_2	2096	65	14-APR-1994	14:59:47	12371 94108j115_2	1814	15	23-APR-1994	19:05:35
12101 94094j101_2	2166	65	6-APR-1994	13:57:17	12228 94101j108_2	262	65	14-APR-1994	17:33:59	12372 94108j115_2	1815	15	23-APR-1994	20:38:33
12102 94094j101_2	1202	65	6-APR-1994	15:53:09	12229 94101j108_2	2073	65	14-APR-1994	18:06:01	12373 94108j115_2	1812	15	23-APR-1994	22:11:35
12103 94094j101_2	2165	65	6-APR-1994	17:05:19	12230 94101j108_2	1424	15	14-APR-1994	21:34:09	12374 94108j115_2	1470	15	23-APR-1994	22:44:19
12104 94094j101_2	1211	65	6-APR-1994	19:02:23	12231 94101j108_2	106	15	14-APR-1994	23:51:07	12375 94108j115_2	1814	45	24-APR-1994	01:17:23
12105 94094j101_2	854	65	6-APR-1994	23:26:47	12232 94101j108_2	2082	15	15-APR-1994	00:18:11	12376 94108j115_2	1815	45	24-APR-1994	02:50:17
12106 94094j101_2	1047	45	7-APR-1994	01:17:09	12233 94101j108_2	267	15	15-APR-1994	02:51:47	12377 94108j115_2	1814	45	24-APR-1994	04:23:17
12107 94094j101_2	2166	45	7-APR-1994	02:29:21	12234 94101j108_2	2050	15	15-APR-1994	15:49:11	12378 94108j115_2	1813	45	24-APR-1994	05:56:17
12108 94094j101_2	1204	45	7-APR-1994	04:25:09	12235 94101j108_2	283	15	15-APR-1994	18:21:05	12379 94108j115_2	642	45	24-APR-1994	07:29:19
12109 94094j101_2	2167	45	7-APR-1994	05:37:21	12236 94101j108_2	2042	15	15-APR-1994	18:55:27	12380 94108j115_2	396	65	24-APR-1994	08:16:31
12110 94094j101_2	1210	45	7-APR-1994	07:33:05	12237 94101j108_2	287	15	15-APR-1994	21:26:55	12381 94108j115_2	1794	65	24-APR-1994	09:02:15
12111 94094j101_2	662	45	7-APR-1994	08:20:11	12238 94101j108_2	2042	15	15-APR-1994	22:01:35	12382 94108j115_2	1781	65	24-APR-1994	10:35:15
12112 94094j101_2	756	65	7-APR-1994	08:45:21	12239 94101j108_2	280	15	16-APR-1994	00:32:49	12383 94108j115_2	1792	65	24-APR-1994	12:08:11
12113 94094j101_2	1199	65	7-APR-1994	10:41:39	12240 94101j108_2	1991	15	16-APR-1994	01:08:33	12384 94108j115_2	1787	65	24-APR-1994	13:41:11
12114 94094j101_2	2152	65	7-APR-1994	11:53:23	12241 94101j108_2	1997	45	16-APR-1994	04:14:17	12385 94108j115_2	1786	65	24-APR-1994	15:14:09
12115 94094j101_2	1208	65	7-APR-1994	13:49:53	12242 94101j108_2	281	45	16-APR-1994	06:44:37	12386 94108j115_2	1807	15	24-APR-1994	16:47:07
12116 94094j101_2	1209	65	7-APR-1994	15:01:23	12243 94101j108_2	1079	45	16-APR-1994	07:20:13	12387 94108j115_2	1803	15	24-APR-1994	18:20:07
12117 94094j101_2	2140	65	7-APR-1994	16:58:05	12244 94101j108_2	290	15	16-APR-1994	16:02:19	12388 94108j115_2	1802	15	24-APR-1994	19:53:07
12118 94094j101_2	1101	65	7-APR-1994	18:09:23	12245 94101j108_2	1998	15	16-APR-1994	16:38:43	12389 94108j115_2	1803	15	24-APR-1994	21:26:03
12119 94094j101_2	1760	45	8-APR-1994	00:25:25	12246 94101j108_2	292	15	16-APR-1994	19:08:09	12390 94108j115_2	1803	15	24-APR-1994	22:58:59
12120 94094j101_2	1211	45	8-APR-1994	02:21:03	12247 94101j108_2	1976	15	16-APR-1994	19:44:55	12391 94108j115_2	1809	15	25-APR-1994	00:31:47
12121 94094j101_2	2171	45	8-APR-1994	03:33:25	12248 94101j108_2	297	15	16-APR-1994	22:14:01	12392 94108j115_2	1803	15	25-APR-1994	02:04:53
12122 94094j101_2	1213	45	8-APR-1994	05:29:03	12249 94101j108_2	296	15	16-APR-1994	22:51:09	12393 94115j122_2	1776	65	25-APR-1994	08:16:53
12123 94094j101_2	2171	45	8-APR-1994	06:41:25	12250 94101j108_2	296	15	17-APR-1994	01:19:59	12394 94115j122_2	1777	65	25-APR-1994	09:49:51
12124 94094j101_2	566	45	8-APR-1994	06:41:25	12251 94101j108_2	1950	45	17-APR-1994	01:57:19	12395 94115j122_2	1775	65	25-APR-1994	11:22:49
12125 94094j101_2	1138	65	8-APR-1994	15:27:31	12252 94101j108_2	282	45	17-APR-1994	04:25:55	12396 94115j122_2	1774	65	25-APR-1994	12:55:49
12126 94094j101_2	1196	65	8-APR-1994	16:05:25	12253 94101j108_2	1947	45	17-APR-1994	05:03:25	12397 94115j122_2	1774	65	25-APR-1994	14:28:43
12127 94094j101_2	2169	65	8-APR-1994	18:01:09	12254 94101j108_2	281	45	17-APR-1994	07:31:45	12398 94115j122_2	1646	65	25-APR-1994	16:01:43
12128 94094j101_2	704	65	8-APR-1994	19:13:25	12255 94101j108_2	310	15	17-APR-1994	16:46:31	12399 94115j122_2	1771	65	25-APR-1994	17:34:41
12129 94094j101_2	2167	45	8-APR-1994	00:17:13	12256 94101j108_2	1922	15	17-APR-1994	17:25:01	12400 94115j122_2	1758	65	25-APR-1994	19:07:41
12130 94094j101_2	1211	45	8-APR-1994	01:29:27	12257 94101j108_2	325	15	17-APR-1994	19:52:19	12401 94115j122_2	331	45	26-APR-1994	03:40:23
12131 94094j101_2	749	45	8-APR-1994	03:25:15	12258 94101j108_2	1938	15	17-APR-1994	20:30:45	12402 94115j122_2	1662	45	26-APR-1994	04:28:53
12132 94094j101_2	2616	45	8-APR-1994	03:50:19	12259 94101j108_2	321	15	17-APR-1994	22:58:17	12403 94115j122_2	1752	45	26-APR-1994	05:58:27
12133 94094j101_2	754	45	8-APR-1994	06:33:13	12260 94101j108_2	1953	15	17-APR-1994	23:36:49	12404 94115j122_2	529	45	26-APR-1994	07:32:21
12134 94094j101_2	1699	45	8-APR-1994	06:58:21	12261 94101j108_2	326	15	18-APR-1994	02:04:03	12405 94115j122_2</				

12466 94115j122_2	1745 15 29-APR-1994 23:50:35	12600 94122j129_2	1598 65 8-MAY-1994 15:29:31	12726 94136j143_2	1639 65 16-MAY-1994 18:40:37
12467 94115j122_2	1742 15 30-APR-1994 01:23:35	12601 94122j129_2	1620 65 8-MAY-1994 17:01:53	12727 94136j143_2	933 65 16-MAY-1994 20:13:35
12468 94115j122_2	1647 15 30-APR-1994 02:56:31	12602 94122j129_2	1599 65 8-MAY-1994 18:34:51	12730 94136j143_2	1623 45 17-MAY-1994 00:52:27
12469 94115j122_2	1718 45 30-APR-1994 04:29:31	12605 94122j129_2	1628 15 8-MAY-1994 23:13:45	12731 94136j143_2	1606 45 17-MAY-1994 02:25:27
12470 94115j122_2	1722 45 30-APR-1994 06:02:43	12606 94122j129_2	1629 15 9-MAY-1994 00:46:41	12732 94136j143_2	1617 45 17-MAY-1994 03:58:25
12471 94115j122_2	534 45 30-APR-1994 07:35:41	12607 94122j129_2	1627 15 9-MAY-1994 02:19:39	12733 94136j143_2	1606 45 17-MAY-1994 05:31:19
12472 94115j122_2	64 65 30-APR-1994 08:03:15	12608 94122j129_2	392 15 9-MAY-1994 03:52:35	12734 94136j143_2	1605 45 17-MAY-1994 07:04:19
12473 94115j122_2	1735 65 30-APR-1994 09:08:43	12611 94129j136_2	1616 65 9-MAY-1994 08:31:37	12735 94136j143_2	1609 65 17-MAY-1994 08:37:15
12474 94115j122_2	1735 65 30-APR-1994 12:14:41	12612 94129j136_2	1655 65 9-MAY-1994 10:03:37	12736 94136j143_2	1605 65 17-MAY-1994 10:10:17
12475 94115j122_2	1738 65 30-APR-1994 13:47:35	12613 94129j136_2	1655 65 9-MAY-1994 11:36:33	12737 94136j143_2	1598 65 17-MAY-1994 11:43:27
12476 94115j122_2	1735 65 30-APR-1994 15:20:35	12614 94129j136_2	1656 65 9-MAY-1994 13:09:31	12738 94136j143_2	1605 65 17-MAY-1994 13:16:11
12477 94115j122_2	1491 15 30-APR-1994 16:53:03	12621 94129j136_2	1072 15 10-MAY-1994 00:20:01	12739 94136j143_2	1605 65 17-MAY-1994 14:49:07
12478 94115j122_2	1701 15 30-APR-1994 18:26:23	12622 94129j136_2	1628 15 10-MAY-1994 01:33:55	12740 94136j143_2	1620 15 17-MAY-1994 16:22:03
12479 94115j122_2	853 15 30-APR-1994 19:59:29	12623 94129j136_2	1630 15 10-MAY-1994 03:06:49	12741 94136j143_2	1472 15 17-MAY-1994 17:55:03
12484 94115j122_2	1727 45 1-MAY-1994 03:44:15	12624 94129j136_2	382 45 10-MAY-1994 05:21:29	12742 94136j143_2	1617 15 17-MAY-1994 19:28:01
12485 94115j122_2	1738 45 1-MAY-1994 05:17:01	12625 94129j136_2	1653 45 10-MAY-1994 06:12:01	12743 94136j143_2	1614 15 17-MAY-1994 21:00:57
12486 94115j122_2	1733 45 1-MAY-1994 06:50:11	12631 94129j136_2	606 15 10-MAY-1994 16:04:17	12744 94136j143_2	1613 15 17-MAY-1994 22:33:55
12497 94115j122_2	1467 15 2-MAY-1994 00:01:07	12632 94129j136_2	1565 15 10-MAY-1994 17:05:29	12745 94136j143_2	1508 15 18-MAY-1994 00:10:27
12498 94115j122_2	1706 15 2-MAY-1994 01:25:45	12633 94129j136_2	1646 15 10-MAY-1994 18:35:47	12746 94136j143_2	1013 15 18-MAY-1994 01:39:49
12499 94115j122_2	1417 15 2-MAY-1994 02:58:47	12634 94129j136_2	1628 15 10-MAY-1994 20:08:45	12746 94136j143_2	587 45 18-MAY-1994 02:13:47
12502 94122j129_2	132 65 2-MAY-1994 08:30:43	12635 94129j136_2	1649 15 10-MAY-1994 21:41:41	12747 94136j143_2	1616 45 18-MAY-1994 03:12:49
12503 94122j129_2	1686 65 2-MAY-1994 09:11:51	12636 94129j136_2	1645 15 10-MAY-1994 23:14:39	12748 94136j143_2	1604 45 18-MAY-1994 04:45:43
12504 94122j129_2	1674 65 2-MAY-1994 10:45:07	12637 94129j136_2	1580 15 11-MAY-1994 00:47:55	12749 94136j143_2	1602 45 18-MAY-1994 06:18:43
12505 94122j129_2	1674 65 2-MAY-1994 12:17:47	12638 94129j136_2	1618 15 11-MAY-1994 02:20:55	12750 94136j143_2	392 45 18-MAY-1994 07:51:57
12506 94122j129_2	1679 65 2-MAY-1994 13:50:51	12639 94129j136_2	1614 45 11-MAY-1994 03:54:39	12754 94136j143_2	8 65 18-MAY-1994 14:18:53
12507 94122j129_2	1679 65 2-MAY-1994 15:23:45	12640 94129j136_2	1632 45 11-MAY-1994 05:26:35	12755 94136j143_2	1606 65 18-MAY-1994 15:36:31
12508 94122j129_2	427 65 2-MAY-1994 16:56:45	12641 94129j136_2	1644 45 11-MAY-1994 06:59:29	12756 94136j143_2	1611 15 18-MAY-1994 17:09:27
12509 94122j129_2	1679 65 2-MAY-1994 18:29:41	12645 94129j136_2	1637 65 11-MAY-1994 13:11:35	12757 94136j143_2	1604 15 18-MAY-1994 18:42:21
12510 94122j129_2	1620 15 2-MAY-1994 20:04:15	12646 94129j136_2	1653 65 11-MAY-1994 14:44:19	12758 94136j143_2	1526 15 18-MAY-1994 20:15:21
12511 94122j129_2	1678 15 2-MAY-1994 21:35:37	12647 94129j136_2	1617 15 11-MAY-1994 16:17:15	12759 94136j143_2	1573 15 18-MAY-1994 21:18:49
12512 94122j129_2	1676 15 2-MAY-1994 23:08:37	12648 94129j136_2	1638 15 11-MAY-1994 17:50:11	12760 94136j143_2	1612 15 18-MAY-1994 23:21:13
12513 94122j129_2	1676 15 3-MAY-1994 00:41:35	12649 94129j136_2	1609 15 11-MAY-1994 19:23:09	12761 94136j143_2	1611 15 19-MAY-1994 00:54:13
12514 94122j129_2	1675 15 3-MAY-1994 02:14:29	12650 94129j136_2	1637 15 11-MAY-1994 20:56:07	12762 94136j143_2	1598 45 19-MAY-1994 02:27:17
12515 94122j129_2	265 15 3-MAY-1994 03:47:33	12651 94129j136_2	1595 15 11-MAY-1994 22:30:27	12763 94136j143_2	1584 45 19-MAY-1994 04:00:17
12515 94122j129_2	126 45 3-MAY-1994 04:39:11	12652 94129j136_2	1297 15 12-MAY-1994 00:02:49	12764 94136j143_2	1593 45 19-MAY-1994 05:33:09
12516 94122j129_2	1668 45 3-MAY-1994 05:20:35	12653 94129j136_2	1613 15 12-MAY-1994 01:35:21	12765 94136j143_2	1601 45 19-MAY-1994 07:05:59
12517 94122j129_2	1669 45 3-MAY-1994 06:53:33	12654 94129j136_2	1629 45 12-MAY-1994 03:07:59	12766 94136j143_2	1578 65 19-MAY-1994 08:39:05
12518 94122j129_2	1566 65 3-MAY-1994 08:30:07	12655 94129j136_2	1572 45 12-MAY-1994 04:42:27	12767 94136j143_2	1600 65 19-MAY-1994 10:11:59
12519 94122j129_2	1670 65 3-MAY-1994 09:59:27	12656 94129j136_2	1627 45 12-MAY-1994 06:13:53	12768 94136j143_2	1597 65 19-MAY-1994 11:44:59
12520 94122j129_2	1671 65 3-MAY-1994 11:32:21	12657 94129j136_2	914 65 12-MAY-1994 08:10:41	12769 94136j143_2	1599 65 19-MAY-1994 13:17:55
12522 94122j129_2	1668 65 3-MAY-1994 14:38:19	12658 94129j136_2	1628 65 12-MAY-1994 09:19:49	12770 94136j143_2	1600 65 19-MAY-1994 14:50:53
12523 94122j129_2	1638 15 3-MAY-1994 16:11:19	12659 94129j136_2	1628 65 12-MAY-1994 10:52:45	12771 94136j143_2	1500 65 19-MAY-1994 16:23:53
12524 94122j129_2	1670 15 3-MAY-1994 17:44:11	12660 94129j136_2	1626 65 12-MAY-1994 12:25:45	12772 94136j143_2	1599 65 19-MAY-1994 17:56:49
12525 94122j129_2	1667 15 3-MAY-1994 19:17:11	12661 94129j136_2	1626 65 12-MAY-1994 13:58:43	12773 94136j143_2	1596 65 19-MAY-1994 19:29:45
12526 94122j129_2	219 15 3-MAY-1994 20:50:11	12662 94129j136_2	1656 65 12-MAY-1994 15:31:39	12774 94136j143_2	971 15 19-MAY-1994 21:23:55
12527 94122j129_2	1581 15 3-MAY-1994 22:25:37	12663 94129j136_2	1616 65 12-MAY-1994 17:04:31	12775 94136j143_2	1603 15 19-MAY-1994 22:35:47
12528 94122j129_2	1666 15 3-MAY-1994 23:56:07	12664 94129j136_2	1626 65 12-MAY-1994 18:37:09	12776 94136j143_2	1599 15 20-MAY-1994 02:08:53
12529 94122j129_2	1652 15 4-MAY-1994 01:29:09	12665 94129j136_2	1027 65 12-MAY-1994 20:10:07	12777 94136j143_2	1595 15 20-MAY-1994 04:41:59
12530 94122j129_2	1653 15 4-MAY-1994 03:02:05	12666 94129j136_2	1571 45 13-MAY-1994 00:51:15	12778 94136j143_2	1591 15 20-MAY-1994 03:14:51
12531 94122j129_2	1611 45 4-MAY-1994 04:36:43	12667 94129j136_2	1640 45 13-MAY-1994 02:21:55	12781 94136j143_2	886 65 20-MAY-1994 08:16:59
12532 94122j129_2	1663 45 4-MAY-1994 06:08:01	12670 94129j136_2	1626 45 13-MAY-1994 03:54:55	12782 94136j143_2	1587 65 20-MAY-1994 09:26:21
12533 94122j129_2	487 45 4-MAY-1994 07:40:57	12671 94129j136_2	1628 45 13-MAY-1994 05:27:49	12783 94136j143_2	1597 65 20-MAY-1994 10:59:21
12537 94122j129_2	461 65 4-MAY-1994 14:32:51	12672 94129j136_2	1637 45 13-MAY-1994 07:00:47	12784 94136j143_2	1598 65 20-MAY-1994 12:32:15
12538 94122j129_2	1656 65 4-MAY-1994 15:25:51	12673 94129j136_2	1651 65 13-MAY-1994 08:33:51	12785 94136j143_2	1596 65 20-MAY-1994 14:05:13
12539 94122j129_2	1657 65 4-MAY-1994 16:58:49	12674 94129j136_2	1648 65 13-MAY-1994 10:06:47	12786 94136j143_2	1600 65 20-MAY-1994 15:38:09
12540 94122j129_2	1656 65 4-MAY-1994 18:31:47	12675 94129j136_2	1650 65 13-MAY-1994 11:39:45	12787 94136j143_2	1605 15 20-MAY-1994 17:11:11
12541 94122j129_2	211 15 4-MAY-1994 20:52:57	12676 94129j136_2	1656 65 13-MAY-1994 13:12:41	12788 94136j143_2	1590 15 20-MAY-1994 18:44:45
12542 94122j129_2	931 65 4-MAY-1994 21:07:45	12677 94129j136_2	1655 65 13-MAY-1994 14:45:39	12789 94136j143_2	1576 15 20-MAY-1994 20:17:13
12543 94122j129_2	1640 15 4-MAY-1994 21:37:41	12678 94129j136_2	1631 15 13-MAY-1994 16:18:37	12790 94136j143_2	1585 15 20-MAY-1994 21:50:05
12544 94122j129_2	1652 15 4-MAY-1994 23:10:43	12679 94129j136_2	1627 15 13-MAY-1994 17:51:31	12791 94136j143_2	1603 15 20-MAY-1994 23:23:03
12545 94122j129_2	1655 45 4-MAY-1994 00:43:37	12680 94129j136_2	1632 15 13-MAY-1994 19:24:31	12792 94136j143_2	1604 15 21-MAY-1994 00:55:59
12546 94122j129_2	1647 45 4-MAY-1994 02:16:35	12681 94129j136_2	1633 15 13-MAY-1994 20:57:27	12793 94136j143_2	1614 45 21-MAY-1994 02:28:57
12547 94122j129_2	1653 45 4-MAY-1994 03:49:35	12682 94129j136_2	1629 15 13-MAY-1994 22:30:27	12794 94136j143_2	1611 45 21-MAY-1994 04:01:51
12548 94122j129_2	1652 45 4-MAY-1994 05:22:33	12683 94129j136_2	1630 15 14-MAY-1994 00:03:23	12795 94136j143_2	1606 45 21-MAY-1994 05:34:53
12549 94122j129_2	1602 45 4-MAY-1994 06:55:29	12684 94129j136_2	1554 15 14-MAY-1994 01:36:17	12796 94136j143_2	1585 45 21-MAY-1994 07:08:29
12549 94122j129_2	1654 65 4-MAY-1994 08:27:27	12685 94129j136_2	1612 45 14-MAY-1994 03:09:19	12797 94136j143_2	1586 65 21-MAY-1994 08:40:47
12550 94122j129_2	1649 65 4-MAY-1994 10:00:25	12686 94129j136_2	1633 45 14-MAY-1994 04:42:15	12798 94136j143_2	1593 65 21-MAY-1994 10:13:47
12551 94122j129_2	1651 65 4-MAY-1994 11:33:25	12687 94129j136_2	407 45 14-MAY-1994 06:15:11	12799 94136j143_2	1595 65 21-MAY-1994 11:46:41
12552 94122j129_2	1653 65 4-MAY-1994 13:06:21	12688 94129j136_2	889 45 14-MAY-1994 07:48:07	12800 94136j143_2	1591 65 21-MAY-1994 13:19:41
12553 94122j129_2	1649 65 4-MAY-1994 14:39:19	12689 94129j136_2	1618 65 14-MAY-1994 09:12:31	12801 94136j143_2	1395 65 21-MAY-1994 14:52:39
12554 94122j129_2	1658 15 4-MAY-1994 16:12:19	12690 94129j136_2	1617 65 14-MAY-1994 10:54:07	12802 94136j143_2	194 15 21-MAY-1994 16:25:35
12555 94122j129_2	1659 15 4-MAY-1994 17:45:15	12691 94129j136_2	1609 65 14-MAY-1994 12:27:03	12803 94136j143_2	1624 15 21-MAY-1994 17:57:55
12556 94122j129_2	1583 15 4-MAY-1994 19:18:17	12692 94129j136_2	1616 65 14-MAY-1994 14:00:03	12804 94136j143_2	1603 15 21-MAY-1994 19:31:29
12557 94122j129_2	1657 15 4-MAY-1994 20:51:15	12693 94129j136_2	1611 65 14-MAY-1994 15:33:01	12805 94136j143_2	1583 15 21-MAY-1994 21:04:49
12558 94122j129_2	1657 15 4-MAY-1994 22:24:11	12694 94129j136_2	1628 15 14-MAY-1994 17:05:55	12806 94136j143_2	1602 15 21-MAY-1994 22:37:27
12559 94122j129_2	1658 15 4-MAY-1994 23:57:11	12695 94129j136_2	1628 15 14-MAY-1994 18:38:55	12807 94136j143_2	1601 15 22-MAY-1994 00:10:23
12560 94122j129_2	1655 15 6-MAY-1994 01:30:11	1			

12842	94143j150.2	1598	45	24-MAY-1994	06:23:59	12963	94150j157.2	1549	45	1-JUN-1994	01:52:01	13113	94157j164.2	1572	15	10-JUN-1994	18:15:07
12843	94143j150.2	385	45	24-MAY-1994	07:57:03	12964	94150j157.2	1560	45	1-JUN-1994	03:25:43	13114	94157j164.2	841	15	10-JUN-1994	20:12:29
12843	94143j150.2	771	65	24-MAY-1994	08:24:05	12965	94150j157.2	1435	45	1-JUN-1994	04:58:07	13115	94157j164.2	1570	15	10-JUN-1994	21:21:03
12844	94143j150.2	1584	65	24-MAY-1994	09:29:57	12971	94150j157.2	1558	65	1-JUN-1994	14:15:59	13116	94157j164.2	832	15	10-JUN-1994	23:18:35
12845	94143j150.2	1585	65	24-MAY-1994	11:02:55	12972	94150j157.2	1568	65	1-JUN-1994	15:48:37	13117	94157j164.2	1571	15	11-JUN-1994	00:26:57
12846	94143j150.2	1584	65	24-MAY-1994	12:35:51	12973	94150j157.2	1569	65	1-JUN-1994	17:21:35	13118	94157j164.2	822	45	11-JUN-1994	02:24:21
12847	94143j150.2	1583	65	24-MAY-1994	14:08:49	12974	94150j157.2	1551	65	1-JUN-1994	18:54:43	13119	94157j164.2	1560	45	11-JUN-1994	03:32:51
12848	94143j150.2	1585	65	24-MAY-1994	15:41:45	12975	94150j157.2	1484	65	1-JUN-1994	20:27:29	13120	94157j164.2	838	45	11-JUN-1994	05:30:03
12849	94143j150.2	1591	15	24-MAY-1994	17:14:49	12979	94150j157.2	1567	45	2-JUN-1994	02:39:19	13121	94157j164.2	1563	45	11-JUN-1994	06:38:45
12850	94143j150.2	1592	15	24-MAY-1994	18:47:45	12980	94150j157.2	1142	45	2-JUN-1994	04:12:17	13122	94157j164.2	433	65	11-JUN-1994	08:50:21
12851	94143j150.2	1591	15	24-MAY-1994	20:20:43	12982	94150j157.2	1571	45	2-JUN-1994	07:18:07	13123	94157j164.2	1594	65	11-JUN-1994	09:44:39
12852	94143j150.2	1589	15	24-MAY-1994	21:53:41	12983	94150j157.2	1566	65	2-JUN-1994	08:51:05	13124	94157j164.2	856	65	11-JUN-1994	11:42:07
12853	94143j150.2	1593	15	24-MAY-1994	23:26:37	12984	94150j157.2	1567	65	2-JUN-1994	10:24:07	13125	94157j164.2	1586	65	11-JUN-1994	12:50:35
12854	94143j150.2	1438	15	25-MAY-1994	00:59:39	12985	94150j157.2	1564	65	2-JUN-1994	11:57:11	13126	94157j164.2	840	65	11-JUN-1994	14:48:55
12855	94143j150.2	1592	45	25-MAY-1994	02:32:33	12986	94150j157.2	1567	65	2-JUN-1994	13:30:01	13127	94157j164.2	1558	65	11-JUN-1994	15:56:31
12856	94143j150.2	1595	45	25-MAY-1994	04:05:29	12987	94150j157.2	1565	65	2-JUN-1994	15:02:59	13128	94157j164.2	838	15	11-JUN-1994	17:53:53
12857	94143j150.2	1586	45	25-MAY-1994	05:38:45	12988	94150j157.2	1506	65	2-JUN-1994	16:35:53	13129	94157j164.2	1571	15	11-JUN-1994	19:02:23
12858	94143j150.2	1578	45	25-MAY-1994	07:11:25	12989	94150j157.2	1556	65	2-JUN-1994	18:09:11	13130	94157j164.2	842	15	11-JUN-1994	20:59:35
12864	94143j150.2	1590	15	25-MAY-1994	16:29:09	12990	94150j157.2	207	65	2-JUN-1994	20:06:15	13131	94157j164.2	1568	15	11-JUN-1994	22:08:17
12865	94143j150.2	1593	15	25-MAY-1994	18:02:07	12991	94150j157.2	1575	15	2-JUN-1994	21:14:49	13132	94157j164.2	843	15	12-JUN-1994	00:05:31
12866	94143j150.2	1592	15	25-MAY-1994	19:35:03	12992	94150j157.2	839	15	2-JUN-1994	23:12:53	13133	94157j164.2	1561	45	12-JUN-1994	01:14:09
12867	94143j150.2	1590	15	25-MAY-1994	21:08:01	12993	94150j157.2	1577	15	3-JUN-1994	00:20:45	13134	94157j164.2	837	45	12-JUN-1994	03:11:27
12868	94143j150.2	1593	15	25-MAY-1994	22:40:53	12994	94150j157.2	817	45	3-JUN-1994	02:18:23	13135	94157j164.2	1559	45	12-JUN-1994	04:20:05
12869	94143j150.2	1575	15	26-MAY-1994	00:14:05	12995	94150j157.2	1577	45	3-JUN-1994	03:26:37	13136	94157j164.2	841	45	12-JUN-1994	06:17:23
12870	94143j150.2	1565	45	26-MAY-1994	01:47:29	12998	94150j157.2	705	65	3-JUN-1994	08:33:49	13137	94157j164.2	1560	45	12-JUN-1994	07:25:59
12871	94143j150.2	1582	45	26-MAY-1994	03:19:47	12999	94150j157.2	1566	65	3-JUN-1994	09:38:25	13138	94157j164.2	866	65	12-JUN-1994	09:23:29
12872	94143j150.2	1555	45	26-MAY-1994	04:53:43	13000	94150j157.2	815	65	3-JUN-1994	11:36:03	13139	94157j164.2	1556	65	12-JUN-1994	10:31:57
12873	94143j150.2	1581	45	26-MAY-1994	06:25:43	13001	94150j157.2	1566	65	3-JUN-1994	12:44:19	13140	94157j164.2	856	65	12-JUN-1994	12:29:21
12874	94143j150.2	515	45	26-MAY-1994	07:58:41	13002	94150j157.2	831	65	3-JUN-1994	14:41:45	13141	94157j164.2	1560	65	12-JUN-1994	13:37:49
12874	94143j150.2	878	65	26-MAY-1994	08:22:07	13003	94150j157.2	1488	65	3-JUN-1994	15:50:11	13142	94157j164.2	831	65	12-JUN-1994	15:35:01
12875	94143j150.2	1581	65	26-MAY-1994	09:31:39	13004	94150j157.2	831	65	3-JUN-1994	17:47:41	13143	94157j164.2	1572	15	12-JUN-1994	16:43:41
12876	94143j150.2	1579	65	26-MAY-1994	11:04:39	13005	94150j157.2	1562	65	3-JUN-1994	18:56:07	13144	94157j164.2	843	15	12-JUN-1994	18:40:59
12877	94143j150.2	1573	65	26-MAY-1994	12:37:37	13006	94150j157.2	702	65	3-JUN-1994	20:53:37	13145	94157j164.2	1570	15	12-JUN-1994	19:49:35
12878	94143j150.2	1579	65	26-MAY-1994	14:10:33	13007	94150j157.2	1575	15	3-JUN-1994	22:02:05	13146	94157j164.2	842	15	12-JUN-1994	21:46:53
12879	94143j150.2	1579	65	26-MAY-1994	15:43:31	13008	94150j157.2	839	15	3-JUN-1994	23:58:35	13147	94157j164.2	1571	15	12-JUN-1994	22:55:31
12880	94143j150.2	1579	65	26-MAY-1994	17:16:27	13009	94150j157.2	1490	45	4-JUN-1994	01:10:55	13148	94157j164.2	839	15	13-JUN-1994	00:52:51
12881	94143j150.2	1578	65	26-MAY-1994	18:49:25	13010	94150j157.2	829	45	4-JUN-1994	03:05:29	13149	94157j164.2	1567	45	13-JUN-1994	02:01:25
12882	94143j150.2	1577	65	26-MAY-1994	20:22:25	13011	94150j157.2	1567	45	4-JUN-1994	04:13:49	13150	94157j164.2	828	45	13-JUN-1994	03:58:49
12883	94143j150.2	1589	15	26-MAY-1994	21:55:25	13012	94150j157.2	833	45	4-JUN-1994	06:11:13	13151	94157j164.2	1566	45	13-JUN-1994	05:07:19
12884	94143j150.2	1568	15	26-MAY-1994	23:28:59	13013	94150j157.2	1556	45	4-JUN-1994	07:19:45	13152	94164j171.2	848	45	13-JUN-1994	07:04:29
12885	94143j150.2	1549	15	27-MAY-1994	01:01:13	13014	94150j157.2	831	65	4-JUN-1994	09:17:15	13153	94164j171.2	958	45	13-JUN-1994	08:13:11
12886	94143j150.2	1558	45	27-MAY-1994	02:34:53	13015	94150j157.2	1565	65	4-JUN-1994	10:25:43	13164	94164j171.2	834	45	14-JUN-1994	01:39:59
12887	94143j150.2	1593	45	27-MAY-1994	04:07:11	13016	94150j157.2	828	65	4-JUN-1994	12:23:11	13165	94164j171.2	1546	45	14-JUN-1994	02:48:33
12888	94143j150.2	632	45	27-MAY-1994	05:40:11	13017	94150j157.2	1564	65	4-JUN-1994	13:31:39	13166	94164j171.2	823	45	14-JUN-1994	04:46:07
12890	94143j150.2	1578	65	27-MAY-1994	08:46:05	13018	94150j157.2	828	65	4-JUN-1994	15:29:07	13167	94164j171.2	1561	45	14-JUN-1994	05:54:25
12891	94143j150.2	1568	65	27-MAY-1994	10:19:03	13019	94150j157.2	1562	65	4-JUN-1994	16:37:33	13168	94164j171.2	557	45	14-JUN-1994	07:51:53
12892	94143j150.2	1578	65	27-MAY-1994	11:52:01	13020	94150j157.2	825	65	4-JUN-1994	18:35:03	13169	94164j171.2	1543	65	14-JUN-1994	09:01:01
12893	94143j150.2	1577	65	27-MAY-1994	13:24:57	13021	94150j157.2	1563	65	4-JUN-1994	19:43:27	13170	94164j171.2	809	65	14-JUN-1994	10:58:03
12894	94143j150.2	1577	65	27-MAY-1994	14:57:55	13024	94150j157.2	843	15	5-JUN-1994	00:46:41	13171	94164j171.2	1397	65	14-JUN-1994	12:11:45
12895	94143j150.2	1577	65	27-MAY-1994	16:30:51	13025	94150j157.2	1488	45	5-JUN-1994	01:58:19	13172	94164j171.2	819	65	14-JUN-1994	14:03:53
12896	94143j150.2	1575	65	27-MAY-1994	18:03:51	13026	94150j157.2	842	45	5-JUN-1994	03:52:37	13173	94164j171.2	1506	65	14-JUN-1994	15:13:57
12897	94143j150.2	1575	65	27-MAY-1994	19:36:49	13027	94150j157.2	1577	45	5-JUN-1994	05:01:11	13174	94164j171.2	837	15	14-JUN-1994	17:09:33
12901	94143j150.2	882	15	28-MAY-1994	01:48:33	13029	94150j157.2	664	65	5-JUN-1994	08:37:05	13175	94164j171.2	1572	15	14-JUN-1994	18:18:05
12901	94143j150.2	640	45	28-MAY-1994	02:19:33	13030	94150j157.2	1575	15	5-JUN-1994	10:04:33	13176	94164j171.2	836	15	14-JUN-1994	20:15:29
12903	94143j150.2	1529	45	28-MAY-1994	04:56:19	13031	94150j157.2	1546	65	5-JUN-1994	11:13:01	13177	94164j171.2	1572	15	14-JUN-1994	21:23:27
12904	94143j150.2	1583	45	28-MAY-1994	06:27:33	13032	94150j157.2	549	65	5-JUN-1994	12:45:57	13178	94164j171.2	1376	15	15-JUN-1994	00:36:17
12905	94143j150.2	459	45	28-MAY-1994	08:00:29	13040	94150j157.2	1574	15	6-JUN-1994	01:09:31	13180	94164j171.2	825	15	15-JUN-1994	02:27:41
12905	94143j150.2	829	65	28-MAY-1994	08:25:23	13041	94150j157.2	617	15	6-JUN-1994	02:42:31	13181	94164j171.2	1567	15	15-JUN-1994	03:35:49
12906	94143j150.2	1576	65	28-MAY-1994	09:33:27	13042	94150j157.2	805	45	6-JUN-1994	04:40:41	13182	94164j171.2	822	45	15-JUN-1994	05:33:19
12907	94143j150.2																



13258 94164j171_2	802	15	20-JUN-1994	03:17:57	13412 94178j185_2	350	15	30-JUN-1994	02:08:07	13539 94185j192_2	440	45	8-JUL-1994	06:11:13
13259 94164j171_2	724	15	20-JUN-1994	04:25:55	13413 94178j185_2	1250	15	30-JUN-1994	03:00:01	13541 94185j192_2	604	65	8-JUL-1994	09:37:47
13262 94171j178_2	832	65	20-JUN-1994	09:29:43	13423 94178j185_2	1259	65	30-JUN-1994	18:29:33	13542 94185j192_2	495	65	8-JUL-1994	11:05:03
13263 94171j178_2	1575	65	20-JUN-1994	10:37:39	13424 94178j185_2	484	15	30-JUN-1994	20:17:59	13543 94185j192_2	1220	65	8-JUL-1994	12:23:07
13264 94171j178_2	830	65	20-JUN-1994	12:35:39	13426 94178j185_2	1246	15	30-JUN-1994	21:35:29	13544 94185j192_2	90	65	8-JUL-1994	14:10:59
13265 94171j178_2	1559	65	20-JUN-1994	13:43:33	13427 94178j185_2	1241	15	30-JUN-1994	23:23:53	13545 94185j192_2	1218	65	8-JUL-1994	15:28:57
13266 94171j178_2	806	65	20-JUN-1994	15:41:35	13428 94178j185_2	481	15	1-JUL-1994	00:41:37	13546 94185j192_2	363	15	8-JUL-1994	17:43:07
13267 94171j178_2	1556	65	20-JUN-1994	16:49:29	13429 94178j185_2	1237	15	1-JUL-1994	02:29:45	13548 94185j192_2	513	15	8-JUL-1994	20:22:37
13268 94171j178_2	831	65	20-JUN-1994	18:47:31	13433 94178j185_2	1207	65	1-JUL-1994	03:47:19	13549 94185j192_2	1228	15	8-JUL-1994	21:40:49
13269 94171j178_2	1558	65	20-JUN-1994	19:55:21	13434 94178j185_2	70	65	1-JUL-1994	09:59:59	13550 94185j192_2	526	15	8-JUL-1994	23:28:31
13272 94171j178_2	811	15	21-JUN-1994	00:59:19	13435 94178j185_2	1235	65	1-JUL-1994	11:48:07	13551 94185j192_2	1065	15	9-JUL-1994	00:46:33
13273 94171j178_2	1563	15	21-JUN-1994	02:07:15	13436 94178j185_2	365	65	1-JUL-1994	13:04:59	13552 94185j192_2	471	45	9-JUL-1994	02:34:25
13274 94171j178_2	804	15	21-JUN-1994	04:05:11	13437 94178j185_2	1235	65	1-JUL-1994	15:18:09	13554 94185j192_2	511	45	9-JUL-1994	05:40:19
13277 94171j178_2	112	65	21-JUN-1994	09:07:13	13438 94178j185_2	1235	65	1-JUL-1994	16:10:49	13557 94185j192_2	1219	65	9-JUL-1994	10:04:15
13278 94171j178_2	802	65	21-JUN-1994	10:17:07	13439 94178j185_2	1248	15	1-JUL-1994	17:59:13	13558 94185j192_2	499	65	9-JUL-1994	11:52:09
13279 94171j178_2	1559	65	21-JUN-1994	11:24:49	13440 94178j185_2	477	15	1-JUL-1994	19:16:43	13559 94185j192_2	1220	65	9-JUL-1994	13:10:07
13280 94171j178_2	710	65	21-JUN-1994	13:23:03	13441 94178j185_2	1244	15	1-JUL-1994	21:05:09	13560 94185j192_2	427	65	9-JUL-1994	14:57:55
13293 94171j178_2	1426	65	22-JUN-1994	09:11:37	13442 94178j185_2	475	15	2-JUL-1994	22:22:39	13561 94185j192_2	1221	65	9-JUL-1994	16:15:59
13294 94171j178_2	829	65	22-JUN-1994	11:04:25	13443 94178j185_2	1249	15	2-JUL-1994	00:10:59	13562 94185j192_2	516	15	9-JUL-1994	18:03:49
13295 94171j178_2	1592	65	22-JUN-1994	12:11:57	13444 94178j185_2	479	15	2-JUL-1994	01:28:27	13563 94185j192_2	1229	15	9-JUL-1994	19:21:59
13297 94171j178_2	446	65	22-JUN-1994	15:34:49	13445 94178j185_2	1233	45	2-JUL-1994	03:16:51	13564 94185j192_2	518	15	9-JUL-1994	21:09:43
13298 94171j178_2	1255	15	22-JUN-1994	16:51:39	13446 94178j185_2	376	45	2-JUL-1994	04:34:25	13565 94185j192_2	1230	15	9-JUL-1994	22:27:47
13299 94171j178_2	409	15	22-JUN-1994	18:40:29	13447 94178j185_2	1247	45	2-JUL-1994	06:26:11	13566 94185j192_2	517	15	10-JUL-1994	00:15:39
13300 94171j178_2	1267	15	22-JUN-1994	19:57:01	13448 94178j185_2	467	65	2-JUL-1994	07:40:15	13567 94185j192_2	1218	45	10-JUL-1994	01:33:41
13301 94171j178_2	407	15	22-JUN-1994	21:46:31	13449 94178j185_2	1235	65	2-JUL-1994	08:28:37	13568 94185j192_2	518	45	10-JUL-1994	03:21:31
13302 94171j178_2	1255	15	22-JUN-1994	23:03:21	13450 94178j185_2	471	65	2-JUL-1994	10:46:11	13569 94185j192_2	1226	45	10-JUL-1994	04:39:31
13303 94171j178_2	346	15	23-JUN-1994	00:52:41	13451 94178j185_2	1193	65	2-JUL-1994	12:34:31	13572 94185j192_2	409	65	10-JUL-1994	09:57:53
13304 94171j178_2	1267	15	23-JUN-1994	02:08:49	13452 94178j185_2	484	65	2-JUL-1994	13:53:27	13573 94185j192_2	1221	65	10-JUL-1994	10:51:19
13305 94171j178_2	329	15	23-JUN-1994	04:23:05	13453 94178j185_2	904	65	2-JUL-1994	15:40:23	13574 94185j192_2	501	65	10-JUL-1994	12:39:07
13307 94171j178_2	350	45	23-JUN-1994	07:28:57	13454 94178j185_2	479	15	2-JUL-1994	16:57:59	13575 94185j192_2	1224	65	10-JUL-1994	13:57:13
13308 94171j178_2	1197	45	23-JUN-1994	08:20:37	13455 94178j185_2	902	15	2-JUL-1994	18:46:19	13576 94185j192_2	501	65	10-JUL-1994	15:45:01
13311 94171j178_2	388	65	23-JUN-1994	13:16:43	13456 94178j185_2	478	15	2-JUL-1994	20:03:53	13577 94185j192_2	831	15	10-JUL-1994	17:16:17
13312 94171j178_2	1254	65	23-JUN-1994	14:32:23	13457 94178j185_2	1007	15	2-JUL-1994	21:52:13	13578 94185j192_2	519	15	10-JUL-1994	18:50:55
13313 94171j178_2	404	65	23-JUN-1994	16:21:59	13458 94178j185_2	103	15	3-JUL-1994	00:57:59	13579 94185j192_2	1230	15	10-JUL-1994	20:08:59
13314 94171j178_2	1244	65	23-JUN-1994	17:38:17	13459 94178j185_2	1236	45	3-JUL-1994	02:15:45	13580 94185j192_2	538	15	10-JUL-1994	21:56:41
13315 94171j178_2	273	65	23-JUN-1994	19:52:37	13460 94178j185_2	480	45	3-JUL-1994	04:03:59	13581 94185j192_2	1232	15	10-JUL-1994	23:14:49
13316 94171j178_2	910	15	23-JUN-1994	20:56:31	13461 94178j185_2	1239	45	3-JUL-1994	05:21:37	13582 94185j192_2	532	15	11-JUL-1994	01:02:33
13317 94171j178_2	375	15	23-JUN-1994	22:34:51	13462 94178j185_2	393	65	3-JUL-1994	10:40:21	13583 94185j192_2	1231	15	11-JUL-1994	02:20:39
13318 94171j178_2	1260	15	23-JUN-1994	23:50:07	13463 94178j185_2	1230	65	3-JUL-1994	11:33:23	13584 94185j192_2	209	15	11-JUL-1994	04:08:29
13319 94171j178_2	367	15	24-JUN-1994	01:40:11	13464 94178j185_2	1232	65	3-JUL-1994	14:39:15	13588 94192j199_2	511	65	11-JUL-1994	10:20:19
13320 94171j178_2	1264	15	24-JUN-1994	02:55:53	13465 94178j185_2	1232	15	3-JUL-1994	17:45:09	13589 94192j199_2	1221	65	11-JUL-1994	11:38:23
13324 94171j178_2	759	65	24-JUN-1994	09:13:27	13470 94178j185_2	495	15	3-JUL-1994	19:33:19	13590 94192j199_2	504	65	11-JUL-1994	13:26:13
13325 94171j178_2	430	65	24-JUN-1994	10:57:19	13471 94178j185_2	1243	15	3-JUL-1994	20:50:59	13591 94192j199_2	1217	65	11-JUL-1994	14:44:17
13326 94171j178_2	1225	65	24-JUN-1994	12:13:39	13472 94178j185_2	499	15	3-JUL-1994	22:39:07	13592 94192j199_2	509	65	11-JUL-1994	16:31:59
13327 94171j178_2	433	65	24-JUN-1994	14:03:13	13473 94178j185_2	1242	15	3-JUL-1994	23:56:51	13593 94192j199_2	1218	65	11-JUL-1994	17:50:09
13328 94171j178_2	1260	65	24-JUN-1994	15:20:11	13474 94178j185_2	83	45	4-JUL-1994	01:45:27	13594 94192j199_2	505	65	11-JUL-1994	19:37:57
13334 94171j178_2	113	15	25-JUN-1994	00:53:51	13475 94178j185_2	1242	45	4-JUL-1994	03:02:51	13595 94192j199_2	288	65	11-JUL-1994	20:56:01
13334 94171j178_2	337	45	25-JUN-1994	01:18:11	13476 94178j185_2	476	45	4-JUL-1994	04:51:03	13596 94192j199_2	868	15	12-JUL-1994	00:13:57
13335 94171j178_2	1248	45	25-JUN-1994	02:11:01	13477 94178j185_2	1122	45	4-JUL-1994	06:08:45	13598 94192j199_2	527	15	12-JUL-1994	01:49:41
13336 94171j178_2	427	45	25-JUN-1994	03:59:51	13479 94185j192_2	730	65	4-JUL-1994	09:31:11	13599 94192j199_2	1218	15	12-JUL-1994	03:07:45
13337 94171j178_2	1252	45	25-JUN-1994	05:16:43	13480 94185j192_2	480	65	4-JUL-1994	11:02:41	13603 94192j199_2	466	65	12-JUL-1994	09:44:43
13338 94171j178_2	403	45	25-JUN-1994	07:05:41	13481 94185j192_2	1228	65	4-JUL-1994	12:20:29	13604 94192j199_2	501	65	12-JUL-1994	11:07:29
13339 94171j178_2	1261	45	25-JUN-1994	08:22:03	13482 94185j192_2	478	65	4-JUL-1994	14:08:33	13605 94192j199_2	1219	65	12-JUL-1994	12:25:27
13340 94171j178_2	428	65	25-JUN-1994	10:11:09	13483 94185j192_2	1228	65	4-JUL-1994	15:26:21	13606 94192j199_2	501	65	12-JUL-1994	14:13:25
13341 94171j178_2	1274	65	25-JUN-1994	11:27:53	13484 94185j192_2	461	65	4-JUL-1994	17:14:27	13607 94192j199_2	1220	65	12-JUL-1994	15:31:19
13342 94171j178_2	467	65	25-JUN-1994	13:16:53	13485 94185j192_2	1231	15	4-JUL-1994	18:32:31	13608 94192j199_2	517	15	12-JUL-1994	17:19:17
13343 94171j178_2	1280	65	25-JUN-1994	14:33:51	13486 94185j192_2	491	15	4-JUL-1994	20:20:21	13609 94192j199_2	1231	15	12-JUL-1994	18:37:13
13344 94171j178_2	452	65	25-JUN-1994	16:23:27	13487 94185j192_2	1238	15	4-JUL-1994	21:38:09	13611 94192j199_2	521	15	12-JUL-1994	20:25:07
13347 94171j178_2	1259	15	25-JUN-1994	20:45:45	13488 94185j192_2	480	15	4-JUL-1994	23:26:15	13612 94192j199_2	1233	15	12-JUL-1994	21:43:05
13348 94171j178_2	395	15	25-JUN-1994	22:35:53	13489 94185j192_2	1236	15	5-JUL-1994	00:44:01	13613 94192j199_2	522	15	12-JUL-1994	23:31:01
13349 94171j178_2	1265	15	25-JUN-1994	23:51:31	13490 94185j192_2	95	45	5-JUL-1994	02:32:13	13614 94192j199_2	1224	15	13-JUL-1994	00:49:01
13350 94171j178_2	403	45	26-JUN-1994	01:41:23	13491 94185j192_2	1237	45	5-JUL-1994	03:49:57	13615 94192j199_2	526	15	13-JUL-1994	02:36:47
13352 94171j178_2	82	45	26-JUN-1994	04:46:27	13492 94185j192_2	493	45	5-JUL-1994	05:37:57	13616 94192j199_2	1229	15	13-JUL-1994	03:54:47
13353														

13666 94192j199_2	464	65	16-JUL-1994	11:10:43	13823 94206j213_2	1592	65	26-JUL-1994	14:05:51	13992 94213j220_2	1134	65	6-AUG-1994	11:52:41
13667 94192j199_2	1564	65	16-JUL-1994	12:27:01	13824 94206j213_2	411	65	26-JUL-1994	16:20:43	13993 94213j220_2	1778	65	6-AUG-1994	13:25:35
13668 94192j199_2	468	65	16-JUL-1994	14:16:31	13825 94206j213_2	1595	65	26-JUL-1994	17:11:37	13994 94213j220_2	1129	65	6-AUG-1994	14:58:39
13669 94192j199_2	260	65	16-JUL-1994	15:39:23	13826 94206j213_2	426	15	26-JUL-1994	19:26:31	13995 94213j220_2	1758	65	6-AUG-1994	16:31:25
13670 94192j199_2	391	15	16-JUL-1994	17:47:01	13827 94206j213_2	1593	15	26-JUL-1994	20:17:33	13996 94213j220_2	742	65	6-AUG-1994	18:17:31
13671 94192j199_2	92	65	16-JUL-1994	17:22:25	13832 94206j213_2	379	45	27-JUL-1994	04:45:43	13997 94213j220_2	1695	65	6-AUG-1994	19:37:17
13672 94192j199_2	1577	15	16-JUL-1994	18:38:43	13833 94206j213_2	1596	45	27-JUL-1994	05:35:07	14001 94213j220_2	1788	45	7-AUG-1994	01:49:01
13673 94192j199_2	496	15	16-JUL-1994	20:28:17	13834 94206j213_2	412	45	27-JUL-1994	07:50:11	14002 94213j220_2	1149	45	7-AUG-1994	03:21:55
13674 94192j199_2	1580	15	16-JUL-1994	21:44:35	13839 94206j213_2	1598	65	27-JUL-1994	14:52:41	14003 94213j220_2	1802	45	7-AUG-1994	04:54:57
13675 94192j199_2	492	15	16-JUL-1994	23:34:11	13840 94206j213_2	476	65	27-JUL-1994	17:07:41	14004 94213j220_2	1188	45	7-AUG-1994	06:27:43
13676 94192j199_2	1576	15	17-JUL-1994	00:50:27	13841 94206j213_2	1600	65	27-JUL-1994	17:58:31	14007 94213j220_2	1785	65	7-AUG-1994	11:06:31
13677 94192j199_2	486	15	17-JUL-1994	02:40:03	13843 94206j213_2	497	15	27-JUL-1994	20:13:35	14008 94213j220_2	1161	65	7-AUG-1994	12:39:31
13678 94192j199_2	1020	15	17-JUL-1994	03:56:21	13844 94206j213_2	1580	15	27-JUL-1994	21:04:45	14009 94213j220_2	228	65	7-AUG-1994	14:12:25
13679 94192j199_2	485	45	17-JUL-1994	08:51:49	13845 94206j213_2	471	15	27-JUL-1994	23:19:27	14011 94213j220_2	802	15	7-AUG-1994	17:51:21
13680 94192j199_2	1568	65	17-JUL-1994	10:08:07	13846 94206j213_2	1536	15	28-JUL-1994	00:10:57	14012 94213j220_2	865	15	7-AUG-1994	19:01:13
13681 94192j199_2	470	65	17-JUL-1994	11:57:41	13847 94206j213_2	98	45	28-JUL-1994	02:00:43	14013 94213j220_2	1823	15	7-AUG-1994	20:24:07
13682 94192j199_2	1566	65	17-JUL-1994	13:13:59	13851 94206j213_2	318	65	28-JUL-1994	10:10:45	14014 94213j220_2	1185	15	7-AUG-1994	21:57:05
13683 94192j199_2	467	65	17-JUL-1994	15:03:37	13852 94206j213_2	426	65	28-JUL-1994	11:43:23	14015 94213j220_2	1818	15	7-AUG-1994	23:29:57
13684 94192j199_2	1197	65	17-JUL-1994	16:19:51	13856 94206j213_2	479	15	28-JUL-1994	17:54:37	14016 94213j220_2	1193	15	8-AUG-1994	01:02:51
13685 94192j199_2	481	15	17-JUL-1994	18:09:31	13857 94206j213_2	1594	15	28-JUL-1994	18:45:43	14017 94213j220_2	1821	15	8-AUG-1994	02:35:45
13686 94192j199_2	1579	15	17-JUL-1994	19:25:43	13858 94206j213_2	495	15	28-JUL-1994	21:00:33	14018 94213j220_2	578	45	8-AUG-1994	04:49:41
13687 94192j199_2	509	15	17-JUL-1994	21:14:57	13859 94206j213_2	1605	15	28-JUL-1994	21:51:15	14019 94213j220_2	1824	45	8-AUG-1994	05:41:35
13688 94192j199_2	1581	15	17-JUL-1994	22:31:37	13860 94206j213_2	484	15	29-JUL-1994	00:06:25	14020 94220j227_2	1157	45	8-AUG-1994	07:14:33
13689 94192j199_2	502	15	18-JUL-1994	00:21:07	13861 94206j213_2	1607	15	29-JUL-1994	00:57:03	14021 94220j227_2	1806	65	8-AUG-1994	11:53:21
13690 94192j199_2	1582	15	18-JUL-1994	01:37:27	13862 94206j213_2	401	45	29-JUL-1994	03:13:31	14022 94220j227_2	1133	65	8-AUG-1994	13:27:11
13691 94192j199_2	505	15	18-JUL-1994	03:27:03	13863 94206j213_2	1573	45	29-JUL-1994	04:04:03	14023 94220j227_2	1800	65	8-AUG-1994	14:59:11
13692 94192j199_2	355	65	18-JUL-1994	10:04:25	13864 94206j213_2	431	45	29-JUL-1994	06:18:15	14024 94220j227_2	1162	65	8-AUG-1994	16:32:09
13693 94192j199_2	1560	65	18-JUL-1994	10:55:31	13865 94206j213_2	1608	45	29-JUL-1994	07:08:47	14025 94220j227_2	1811	65	8-AUG-1994	18:04:59
13694 94192j199_2	368	65	18-JUL-1994	12:45:05	13871 94206j213_2	1609	65	29-JUL-1994	16:26:25	14026 94220j227_2	574	15	8-AUG-1994	20:19:13
13695 94192j199_2	1511	65	18-JUL-1994	14:03:19	13872 94206j213_2	422	65	29-JUL-1994	18:41:45	14027 94220j227_2	579	65	8-AUG-1994	19:37:57
13696 94192j199_2	468	65	18-JUL-1994	15:50:57	13873 94206j213_2	1592	65	29-JUL-1994	19:32:17	14028 94220j227_2	1817	15	8-AUG-1994	21:10:49
13697 94192j199_2	892	15	18-JUL-1994	17:28:21	13874 94206j213_2	445	15	29-JUL-1994	21:47:43	14029 94220j227_2	237	65	9-AUG-1994	10:27:07
13698 94192j199_2	480	15	18-JUL-1994	18:56:37	13875 94206j213_2	1611	15	29-JUL-1994	22:38:07	14030 94220j227_2	1180	65	9-AUG-1994	11:07:09
13699 94192j199_2	1578	15	18-JUL-1994	20:12:45	13876 94206j213_2	438	45	30-JUL-1994	00:53:33	14031 94220j227_2	594	15	9-AUG-1994	21:06:07
13700 94192j199_2	488	65	19-JUL-1994	10:25:59	13877 94206j213_2	1608	45	30-JUL-1994	01:44:05	14032 94220j227_2	1159	15	9-AUG-1994	21:57:35
13701 94192j199_2	1581	65	19-JUL-1994	11:42:09	13878 94206j213_2	423	45	30-JUL-1994	03:59:25	14033 94220j227_2	1811	15	9-AUG-1994	23:30:27
13702 94192j199_2	483	65	19-JUL-1994	13:31:55	13879 94206j213_2	1610	45	30-JUL-1994	04:49:55	14034 94220j227_2	453	45	10-AUG-1994	01:03:27
13703 94192j199_2	1584	65	19-JUL-1994	14:48:01	13880 94206j213_2	436	45	30-JUL-1994	07:05:11	14035 94220j227_2	1719	45	10-AUG-1994	02:40:31
13704 94192j199_2	478	65	19-JUL-1994	16:37:47	13881 94206j213_2	441	45	30-JUL-1994	07:55:49	14036 94220j227_2	1162	45	10-AUG-1994	04:09:17
13705 94192j199_2	446	15	19-JUL-1994	19:43:43	13882 94206j213_2	346	65	30-JUL-1994	10:13:49	14037 94220j227_2	1844	45	10-AUG-1994	05:42:09
13706 94192j199_2	1573	15	19-JUL-1994	20:59:43	13883 94206j213_2	1615	65	30-JUL-1994	11:01:33	14038 94220j227_2	565	65	10-AUG-1994	14:09:25
13707 94192j199_2	419	15	19-JUL-1994	22:49:35	13884 94206j213_2	419	65	30-JUL-1994	13:17:15	14039 94220j227_2	1410	65	10-AUG-1994	14:59:49
13708 94192j199_2	1585	15	20-JUL-1994	00:05:37	13885 94206j213_2	1615	65	30-JUL-1994	14:07:25	14040 94220j227_2	1862	45	11-AUG-1994	00:17:09
13709 94192j199_2	484	15	20-JUL-1994	01:55:27	13886 94206j213_2	449	65	30-JUL-1994	16:22:59	14041 94220j227_2	1169	45	11-AUG-1994	01:50:09
13710 94192j199_2	1582	15	20-JUL-1994	03:11:29	13887 94206j213_2	1617	65	30-JUL-1994	17:13:13	14042 94220j227_2	1704	45	11-AUG-1994	03:23:03
13711 94192j199_2	1474	45	20-JUL-1994	06:20:33	13888 94206j213_2	408	65	30-JUL-1994	19:29:05	14043 94220j227_2	1180	45	11-AUG-1994	04:55:57
13712 94192j199_2	395	45	20-JUL-1994	08:31:57	13889 94206j213_2	921	65	30-JUL-1994	20:19:11	14044 94220j227_2	1091	45	11-AUG-1994	06:28:53
13713 94192j199_2	121	65	20-JUL-1994	13:18:11	13890 94206j213_2	447	15	31-JUL-1994	01:40:37	14045 94220j227_2	904	65	11-AUG-1994	13:12:31
13714 94192j199_2	464	65	20-JUL-1994	14:18:41	13891 94206j213_2	1617	15	31-JUL-1994	02:30:51	14046 94220j227_2	577	65	11-AUG-1994	14:13:29
13715 94192j199_2	1590	65	20-JUL-1994	15:35:09	13892 94206j213_2	563	65	31-JUL-1994	10:31:49	14047 94220j227_2	28	15	11-AUG-1994	21:17:47
13716 94192j199_2	517	65	20-JUL-1994	17:24:27	13893 94206j213_2	515	65	31-JUL-1994	12:07:11	14048 94220j227_2	1853	15	11-AUG-1994	21:58:03
13717 94192j199_2	1584	65	20-JUL-1994	18:41:01	13894 94206j213_2	574	65	31-JUL-1994	13:37:39	14049 94220j227_2	460	15	11-AUG-1994	23:00:31
13718 94192j199_2	105	65	20-JUL-1994	20:30:31	13895 94206j213_2	1611	65	31-JUL-1994	14:54:25	14050 94220j227_2	256	45	12-AUG-1994	00:12:47
13719 94192j199_2	486	15	20-JUL-1994	23:36:33	13896 94206j213_2	571	65	31-JUL-1994	16:43:33	14051 94220j227_2	1873	45	12-AUG-1994	01:03:53
13720 94192j199_2	1579	15	21-JUL-1994	00:52:27	13897 94206j213_2	829	65	31-JUL-1994	18:26:11	14052 94220j227_2	1209	45	12-AUG-1994	02:06:23
13721 94192j199_2	477	15	21-JUL-1994	02:42:25	13898 94206j213_2	572	65	31-JUL-1994	19:49:23	14053 94220j227_2	12	45	12-AUG-1994	03:39:19
13722 94192j199_2	802	15	21-JUL-1994	03:58:27	13899 94206j213_2	551	65	1-AUG-1994	11:18:51	14054 94220j227_2	1654	65	12-AUG-1994	13:34:29
13723 94192j199_2	395	45	21-JUL-1994	06:13:03	13900 94206j213_2	549	65	1-AUG-1994	13:03:21	14055 94220j227_2	1208	65	12-AUG-1994	14:29:49
13724 94192j199_2	1572	45	21-JUL-1994	07:04:19	13901 94206j213_2	549	65	1-AUG-1994	14:24:39	14056 94220j227_2	1876	65	12-AUG-1994	16:02:45
13725 94192j199_2	1595	65	21-JUL-1994	10:10:13	13902 94206j213_2	1620	65	1-AUG-1994	15:41:45	14057 94220j227_2	1193	15	12-AUG-1994	18:05:57
13726 94192j199_2	487	65	21-JUL-1994	12:00:11	13903 94206j213_2	575	15	2-AUG-1994	00:59:15	14058 94220j227_2	9	65	12-AUG-1994	17:35:41
13727 94192j199_2	1574	65	21-JUL-1994	13:16:07	13904 94206j213_2	1615	15	2-AUG-1994	02:48:11	14059 94220j227_2	1898	15	12-AUG-1994	19:08:37
13728 94192j199_2	486	65	21-JUL-1994	15:05:57	13905 94206j213_2	615	15	2-AUG-1994	04:08:27	14060 94220j227_2	1214</			

14166	94227j234_2	2027	65	17-AUG-1994	17:19:53	14650	94255j262_2	2020	15	17-SEP-1994	22:07:39
14169	94227j234_2	1171	15	17-AUG-1994	22:04:27	14651	94255j262_2	696	15	17-SEP-1994	23:15:15
14170	94227j234_2	2014	15	17-AUG-1994	23:31:43	14660	94255j262_2	1971	65	18-SEP-1994	13:34:51
14171	94227j234_2	611	15	18-AUG-1994	01:05:01	14661	94255j262_2	681	65	18-SEP-1994	14:41:23
14177	94227j234_2	264	65	18-AUG-1994	11:21:29	14666	94255j262_2	1791	15	18-SEP-1994	22:57:23
14178	94227j234_2	2044	65	18-AUG-1994	11:54:49	14667	94255j262_2	696	15	18-SEP-1994	21:57:03
14179	94227j234_2	1344	65	18-AUG-1994	13:28:53	14674	94262j269_2	1770	65	19-SEP-1994	11:18:33
14180	94227j234_2	2059	65	18-AUG-1994	15:00:27	14675	94262j269_2	759	65	19-SEP-1994	12:17:31
14181	94227j234_2	1385	65	18-AUG-1994	16:33:31	14680	94262j269_2	1960	15	19-SEP-1994	20:27:51
14186	94227j234_2	1914	15	19-AUG-1994	00:23:39	14681	94262j269_2	692	15	19-SEP-1994	21:33:11
14187	94227j234_2	632	15	19-AUG-1994	01:51:11	14690	94262j269_2	1995	65	20-SEP-1994	11:52:47
14193	94227j234_2	756	65	19-AUG-1994	11:52:45	14691	94262j269_2	688	65	20-SEP-1994	12:59:15
14197	94227j234_2	1432	65	19-AUG-1994	17:19:39	14696	94262j269_2	1738	15	20-SEP-1994	21:16:59
14198	94227j234_2	2116	15	19-AUG-1994	18:52:33	14697	94262j269_2	696	15	20-SEP-1994	22:14:53
14202	94227j234_2	2129	15	20-AUG-1994	01:04:03	14706	94262j269_2	1975	65	21-SEP-1994	12:35:09
14208	94227j234_2	1519	65	20-AUG-1994	10:42:03	14707	94262j269_2	693	65	21-SEP-1994	13:40:57
14212	94227j234_2	2153	65	20-AUG-1994	16:32:53	14712	94262j269_2	1974	15	21-SEP-1994	21:49:51
14224	94227j234_2	1978	65	21-AUG-1994	11:14:31	14713	94262j269_2	702	15	21-SEP-1994	22:56:35
14228	94227j234_2	1759	65	21-AUG-1994	17:33:57	14722	94262j269_2	1924	65	22-SEP-1994	13:18:31
14244	94234j241_2	2118	65	22-AUG-1994	18:10:09	14723	94262j269_2	705	65	22-SEP-1994	14:22:29
14246	94234j241_2	2031	15	22-AUG-1994	21:18:49	14728	94262j269_2	1844	15	22-SEP-1994	22:36:49
14256	94234j241_2	2156	65	23-AUG-1994	12:45:19	14729	94262j269_2	675	15	22-SEP-1994	23:38:15
14260	94234j241_2	1771	15	23-AUG-1994	19:11:53	14738	94262j269_2	2039	65	23-SEP-1994	13:56:21
14260	94234j241_2	193	65	23-AUG-1994	19:04:53	14739	94262j269_2	676	65	23-SEP-1994	15:04:17
14261	94234j241_2	463	15	23-AUG-1994	20:10:53	14742	94262j269_2	2023	15	23-SEP-1994	20:07:17
14272	94234j241_2	1871	65	24-AUG-1994	13:34:21	14743	94262j269_2	691	15	23-SEP-1994	21:14:43
14276	94234j241_2	1578	15	24-AUG-1994	20:07:57	14758	94262j269_2	2050	15	24-SEP-1994	20:47:45
14277	94234j241_2	296	15	24-AUG-1994	21:00:31	14759	94262j269_2	668	15	24-SEP-1994	21:56:21
14302	94234j241_2	1379	65	26-AUG-1994	13:03:45	14768	94262j269_2	2051	65	25-SEP-1994	12:13:59
14303	94234j241_2	1095	65	26-AUG-1994	13:49:51	14769	94262j269_2	668	65	25-SEP-1994	13:22:21
14309	94234j241_2	1754	15	26-AUG-1994	23:36:35	14774	94262j269_2	2043	15	25-SEP-1994	21:29:51
14316	94234j241_2	195	65	27-AUG-1994	11:21:21	14784	94269j276_2	1858	65	26-SEP-1994	12:56:15
14317	94234j241_2	2604	65	27-AUG-1994	11:27:51	14785	94269j276_2	417	65	26-SEP-1994	14:12:33
14332	94234j241_2	269	65	28-AUG-1994	12:02:17	14790	94269j276_2	1860	15	26-SEP-1994	22:10:59
14333	94234j241_2	1121	65	28-AUG-1994	12:11:15	14791	94269j276_2	344	15	26-SEP-1994	23:28:33
14337	94234j241_2	1186	15	28-AUG-1994	19:07:29	14800	94269j276_2	1856	65	27-SEP-1994	13:36:49
14356	94241j248_2	787	45	30-AUG-1994	00:49:37	14801	94269j276_2	365	65	27-SEP-1994	14:55:11
14357	94241j248_2	1081	45	30-AUG-1994	01:15:51	14804	94269j276_2	1757	15	27-SEP-1994	19:50:17
14363	94241j248_2	1430	65	30-AUG-1994	11:06:09	14805	94269j276_2	375	15	27-SEP-1994	21:05:47
14370	94241j248_2	539	15	30-AUG-1994	22:35:21	14814	94269j276_2	1766	65	28-SEP-1994	11:15:03
14371	94241j248_2	1194	15	30-AUG-1994	22:53:39	14815	94269j276_2	80	65	28-SEP-1994	12:32:33
14381	94241j248_2	1531	65	31-AUG-1994	14:21:43	14820	94269j276_2	1895	15	28-SEP-1994	20:25:47
14386	94241j248_2	280	15	31-AUG-1994	23:27:27	14821	94269j276_2	197	15	28-SEP-1994	21:47:41
14387	94241j248_2	1733	15	31-AUG-1994	23:36:47	14832	94269j276_2	1867	65	29-SEP-1994	14:54:59
14400	94241j248_2	250	15	1-SEP-1994	21:06:07	14833	94269j276_2	189	65	29-SEP-1994	16:16:47
14401	94241j248_2	1429	15	1-SEP-1994	21:14:25	14836	94269j276_2	1719	15	29-SEP-1994	21:08:59
14411	94241j248_2	1413	65	2-SEP-1994	13:23:13	14837	94269j276_2	168	15	29-SEP-1994	22:26:27
14412	94241j248_2	370	65	2-SEP-1994	15:34:19	14846	94269j276_2	1948	65	30-SEP-1994	12:25:13
14413	94241j248_2	1344	65	2-SEP-1994	15:46:39	14852	94269j276_2	1936	15	30-SEP-1994	21:39:55
14418	94241j248_2	336	15	3-SEP-1994	00:51:33	14853	94269j276_2	126	15	30-SEP-1994	23:05:45
14419	94241j248_2	370	15	3-SEP-1994	01:02:43	14862	94269j276_2	2018	65	1-OCT-1994	13:05:07
14426	94241j248_2	39	65	3-SEP-1994	13:22:53	14863	94269j276_2	41	65	1-OCT-1994	14:28:07
14427	94241j248_2	1703	65	3-SEP-1994	13:24:09	14866	94269j276_2	1885	15	1-OCT-1994	19:13:57
14434	94241j248_2	306	45	4-SEP-1994	01:35:23	14867	94269j276_2	172	15	1-OCT-1994	20:38:59
14435	94241j248_2	1462	45	4-SEP-1994	01:45:33	14878	94269j276_2	1885	65	2-OCT-1994	13:42:19
14438	94241j248_2	355	45	4-SEP-1994	07:44:27	14882	94269j276_2	1975	15	2-OCT-1994	19:53:41
14439	94241j248_2	1440	45	4-SEP-1994	07:56:15	14892	94276j283_2	1918	65	3-OCT-1994	11:14:09
14452	94241j248_2	489	45	5-SEP-1994	05:17:21	14898	94276j283_2	1848	15	3-OCT-1994	20:30:29
14453	94241j248_2	1245	45	5-SEP-1994	05:33:39	14908	94276j283_2	1889	65	4-OCT-1994	11:52:25
14460	94248j255_2	320	65	5-SEP-1994	17:43:53	14914	94276j283_2	1772	15	4-OCT-1994	21:10:39
14461	94248j255_2	793	15	5-SEP-1994	18:16:37	14915	94276j283_2	112	15	4-OCT-1994	22:33:45
14461	94248j255_2	638	65	5-SEP-1994	17:54:33	14926	94276j283_2	1774	65	5-OCT-1994	15:38:19
14466	94248j255_2	280	45	5-SEP-1994	03:01:13	14927	94276j283_2	89	65	5-OCT-1994	17:02:29
14467	94248j255_2	1456	45	6-SEP-1994	03:10:31	14930	94276j283_2	1656	15	5-OCT-1994	21:51:57
14476	94248j255_2	298	15	6-SEP-1994	18:27:15	14940	94276j283_2	1442	65	6-OCT-1994	13:22:15
14477	94248j255_2	1420	15	6-SEP-1994	18:37:09	14941	94276j283_2	108	65	6-OCT-1994	14:35:39
14478	94248j255_2	398	15	6-SEP-1994	21:29:05	14944	94276j283_2	1978	15	6-OCT-1994	19:19:45
14479	94248j255_2	1382	15	6-SEP-1994	21:42:29	14956	94276j283_2	1400	65	7-OCT-1994	13:48:45
14492	94248j255_2	369	15	7-SEP-1994	19:07:11	14957	94276j283_2	85	65	7-OCT-1994	15:13:27
14493	94248j255_2	1352	15	7-SEP-1994	19:19:43	14960	94276j283_2	1860	15	7-OCT-1994	19:55:39
14494	94248j255_2	239	15	7-SEP-1994	22:17:05	14961	94276j283_2	87	15	7-OCT-1994	21:23:29
14495	94248j255_2	1367	15	7-SEP-1994	22:25:03	14970	94276j283_2	1694	65	8-OCT-1994	11:24:07
14508	94248j255_2	78	15	8-SEP-1994	19:59:39	14971	94276j283_2	93	65	8-OCT-1994	12:46:33
14509	94248j255_2	1393	15	8-SEP-1994	20:02:13	14976	94276j283_2	1997	15	8-OCT-1994	20:33:51
14510	94248j255_2	272	15	8-SEP-1994	22:58:29	14986	94276j283_2	1712	65	9-OCT-1994	11:58:15
14511	94248j255_2	1384	15	8-SEP-1994	23:07:31	14992	94276j283_2	1814	15	9-OCT-1994	21:11:53
14522	94248j255_2	399	65	9-SEP-1994	17:26:05						
14523	94248j255_2	1381	65	9-SEP-1994	17:39:21						
14526	94248j255_2	286	45	9-SEP-1994	23:40:07						
14527	94248j255_2	1366	45	9-SEP-1994	23:49:57						
14534	94248j255_2	235	65	10-SEP-1994	12:03:21						
14535	94248j255_2	1389	65	10-SEP-1994	12:11:09						
14538	94248j255_2	391	65	10-SEP-1994	18:08:45						
14539	94248j255_2	1280	65	10-SEP-1994	18:21:45						
14550	94248j255_2	410	65	11-SEP-1994	12:39:53						
14551	94248j255_2	1374	65	11-SEP-1994	12:53:31						
14554	94248j255_2	394	15	11-SEP-1994	18:50:59						
14555	94248j255_2	1399	15	11-SEP-1994	19:04:07						
14570	94255j262_2	276	15	12-SEP-1994	19:32:41						
14571	94255j262_2	1398	15	12-SEP-1994	19:45:33						
14572	94255j262_2	54	15	12-SEP-1994	22:40:47						
14573	94255j262_2	2377	15	12-SEP-1994	22:50:49						
14586	94255j262_2	259	15	13-SEP-1994	20:18:57						
14587	94255j262_2	1423	15	13-SEP-1994							



# **Appendix F**

## **PVO and Magellan Data Arcs**

The following information is included in this appendix:

1. Start and stop times for each data arc for PVO low altitude.
2. Start and stop times for each data arc for PVO high altitude.
3. PVO maneuvers.
3. Start and stop times for each data arc for Magellan cycle4.
4. Start and stop times for each data arc for Magellan cycle5.
5. Hide information for Magellan cycle 4.
6. Hide information for Magellan cycles 5 and 6.

**PVO low altitude data arcs:**

09-DEC-78 10:00	11-DEC-78 04:00	23-MAR-80 21:30	28-MAR-80 21:29
11-DEC-78 06:00	13-DEC-78 04:00	28-MAR-80 21:30	01-APR-80 16:00
16-DEC-78 01:00	20-DEC-78 00:00	01-APR-80 22:50	08-APR-80 00:00
20-DEC-78 07:00	22-DEC-78 22:00	09-APR-80 15:00	15-APR-80 22:00
23-DEC-78 01:00	27-DEC-78 23:00	19-APR-80 17:00	22-APR-80 15:00
28-DEC-78 04:00	03-JAN-79 05:00	22-APR-80 22:45	29-APR-80 03:00
11-JAN-79 10:00	16-JAN-79 09:59	30-APR-80 00:00	05-MAY-80 23:59
17-JAN-79 12:00	24-JAN-79 07:00	07-MAY-80 00:00	13-MAY-80 14:00
24-JAN-79 13:00	31-JAN-79 07:00	14-MAY-80 10:00	20-MAY-80 02:00
31-JAN-79 11:00	02-FEB-79 00:00	21-MAY-80 11:00	25-MAY-80 21:00
02-FEB-79 03:00	07-FEB-79 07:00	25-MAY-80 21:00	30-MAY-80 20:59
07-FEB-79 11:00	13-FEB-79 20:00	30-MAY-80 21:00	03-JUN-80 20:59
14-FEB-79 11:00	17-FEB-79 00:00	03-JUN-80 22:00	08-JUN-80 21:59
17-FEB-79 05:00	21-FEB-79 04:59	08-JUN-80 22:00	12-JUN-80 20:00
22-FEB-79 23:00	27-FEB-79 06:00	12-JUN-80 20:25	19-JUN-80 08:00
27-FEB-79 11:00	03-MAR-79 00:00	19-JUN-80 21:55	26-JUN-80 07:59
03-MAR-79 04:00	08-MAR-79 04:00	26-JUN-80 20:10	03-JUL-80 20:09
08-MAR-79 04:00	13-MAR-79 12:00	03-JUL-80 21:00	10-JUL-80 02:00
14-MAR-79 01:00	18-MAR-79 00:59	10-JUL-80 21:00	13-JUL-80 09:00
18-MAR-79 01:00	22-MAR-79 23:00	13-JUL-80 22:00	21-JUL-80 21:59
23-MAR-79 00:00	28-MAR-79 23:59	21-JUL-80 22:00	28-JUL-80 10:00
29-MAR-79 00:00	03-APR-79 23:30	31-JUL-80 00:00	09-AUG-80 10:00
04-APR-79 02:00	10-APR-79 01:59	09-AUG-80 10:00	17-AUG-80 00:00
10-APR-79 02:00	15-APR-79 01:59	17-AUG-80 00:00	26-AUG-80 23:59
15-APR-79 02:00	19-APR-79 01:59	27-AUG-80 00:00	05-SEP-80 23:59
19-APR-79 02:00	24-APR-79 01:59	06-SEP-80 00:00	15-SEP-80 23:59
25-APR-79 12:00	30-APR-79 02:00	16-SEP-80 00:00	23-SEP-80 10:00
30-APR-79 13:00	08-MAY-79 06:00	25-SEP-80 01:00	05-OCT-80 00:59
11-MAY-79 03:00	16-MAY-79 07:00	05-OCT-80 01:00	15-OCT-80 00:59
16-MAY-79 10:00	24-MAY-79 07:00	15-OCT-80 01:00	25-OCT-80 00:59
24-MAY-79 12:00	28-MAY-79 07:00	25-OCT-80 01:00	04-NOV-80 00:59
29-MAY-79 10:00	31-MAY-79 17:00	04-NOV-80 01:00	14-NOV-80 00:59
01-JUN-79 02:00	06-JUN-79 06:00	14-NOV-80 01:00	23-NOV-80 00:00
06-JUN-79 10:00	14-JUN-79 07:00	23-NOV-80 01:00	04-DEC-80 00:00
14-JUN-79 12:00	22-JUN-79 07:00		
22-JUN-79 12:00	26-JUN-79 00:00		
26-JUN-79 04:00	01-JUL-79 03:59		
01-JUL-79 04:00	06-JUL-79 17:00		
06-JUL-79 17:30	11-JUL-79 17:00		
19-DEC-79 04:00	21-DEC-79 22:00		
21-DEC-79 22:00	27-DEC-79 12:00		
27-DEC-79 22:00	03-JAN-80 10:00		
03-JAN-80 22:00	08-JAN-80 10:00		
09-JAN-80 09:00	15-JAN-80 04:00		
15-JAN-80 22:00	22-JAN-80 12:00		
23-JAN-80 00:00	29-JAN-80 12:00		
29-JAN-80 23:00	05-FEB-80 18:45		
06-FEB-80 09:00	07-FEB-80 19:00		
08-FEB-80 08:00	13-FEB-80 07:59		
13-FEB-80 08:00	18-FEB-80 17:59		
18-FEB-80 18:00	23-FEB-80 17:59		
23-FEB-80 18:00	28-FEB-80 12:00		
28-FEB-80 20:00	07-MAR-80 19:59		
07-MAR-80 20:00	14-MAR-80 14:00		
14-MAR-80 21:30	19-MAR-80 21:29		
19-MAR-80 21:30	23-MAR-80 21:29		

**PVO high altitude data arcs:**

06-NOV-81	13:49	09-NOV-81	06:00
12-NOV-81	05:00	16-NOV-81	06:00
19-NOV-81	23:00	23-NOV-81	06:00
26-NOV-81	23:00	30-NOV-81	06:00
02-DEC-81	13:51	09-DEC-81	10:00
09-DEC-81	10:01	15-DEC-81	10:00
15-DEC-81	10:01	22-DEC-81	10:00
22-DEC-81	10:00	29-DEC-81	02:00
29-DEC-81	10:01	05-JAN-82	10:00
05-JAN-82	10:01	12-JAN-82	10:00
12-JAN-82	10:00	20-JAN-82	05:00
20-JAN-82	10:00	23-JAN-82	06:00
24-JAN-82	23:00	29-JAN-82	06:00
30-JAN-82	23:00	03-FEB-82	05:00
03-FEB-82	10:00	05-FEB-82	06:00
06-FEB-82	23:00	10-FEB-82	06:00
13-FEB-82	23:00	17-FEB-82	06:00
20-FEB-82	23:00	24-FEB-82	06:00
27-FEB-82	23:00	02-MAR-82	05:00
02-MAR-82	10:00	04-MAR-82	06:00
06-MAR-82	23:00	10-MAR-82	06:00
13-MAR-82	23:00	17-MAR-82	06:00
20-MAR-82	23:00	23-MAR-82	22:50
27-MAR-82	23:00	30-MAR-82	22:50
03-APR-82	23:00	06-APR-82	05:00
06-APR-82	10:00	09-APR-82	06:00
10-APR-82	23:00	13-APR-82	22:50
17-APR-82	23:00	20-APR-82	22:50
24-APR-82	23:00	27-APR-82	22:50
01-MAY-82	23:00	04-MAY-82	22:50
08-MAY-82	23:00	11-MAY-82	22:50
15-MAY-82	23:00	18-MAY-82	22:50
22-MAY-82	23:00	25-MAY-82	22:50
29-MAY-82	23:00	01-JUN-82	22:50
05-JUN-82	23:30	08-JUN-82	23:29
12-JUN-82	23:30	15-JUN-82	23:00
19-JUN-82	23:30	22-JUN-82	23:00
26-JUN-82	23:30	29-JUN-82	23:00
03-JUL-82	23:30	06-JUL-82	23:00
10-JUL-82	23:30	13-JUL-82	23:00
17-JUL-82	23:30	20-JUL-82	23:00
24-JUL-82	23:30	27-JUL-82	23:00
31-JUL-82	23:30	03-AUG-82	23:00
07-AUG-82	23:30	10-AUG-82	05:00
14-AUG-82	23:30	17-AUG-82	23:00
20-AUG-82	23:30	24-AUG-82	23:00
28-AUG-82	23:30	31-AUG-82	23:00
04-SEP-82	23:30	07-SEP-82	23:00

# **PVO maneuvers:**

78/341/0536	DEC 07	m alt. 200 km/ period trim
341/0630	DEC 07	m reor.
342/0411	DEC 08	m alt. 180 km
345/0436	DEC 11	m alt. 170 km
347/0451	DEC 13	m alt. 160 km
347/1541	DEC 13	m period trim
349/0536	DEC 15	m spin trim/alt. 155 km
354/0103	DEC 20	m reor.
354/0537	DEC 20	m alt. 150 km
356/2343	DEC 22	m reor.
362/0040	DEC 28	m reor. star map
362/0240	DEC 28	m reor. start Per. Eclipse #1
79/003/0736	JAN 03	m alt. 148 km
003/2145	JAN 03	m period trim/spin trim
011/0851	JAN 11	m alt. 150 km/spin trim
017/1026	JAN 17	m alt. 147 km/spin trim
024/0943	JAN 24	m alt. 145 km/spin trim
024/1113	JAN 24	m reor.
031/0928	JAN 31	m alt. 142 km/spin trim
033/0107	FEB 02	m reor.
038/0947	FEB 07	m spin trim/alt. 142 km
045/0932	FEB 14	m spin trim/alt. 142 km
048/0135	FEB 17	m reor.
052/0930	FEB 21	m spin trim/alt. 142 km
058/0855	FEB 27	m spin trim/alt. 142 km
062/0134	MAR 03	m reor.
072/1904	MAR 13	m period trim/spin trim
073/0037	MAR 14	m reor.
081 2328	MAR 22	m reor.
094/0058	APR 04	m reor./spin trim
115/0945	APR 25	m reor.
115/1145	APR 25	m alt. 148 km/spin trim
120/1125	APR 30	m alt. 148 km/spin trim
128/0930	MAY 08	m reor./alt. reduct./spin trim
136/0900	MAY 16	m spin trim/alt. reduction
144/1030	MAY 24	m spin trim/reor./alt. reduct.
149/1000	MAY 29	m reor./spin trim/alt. reduct.
151/2020	MAY 31	m period trim/spin trim
157/0830	JUN 06	m reor./spin trim/alt. reduct.
165/1130	JUN 14	m reor./spin trim/alt. reduct.
173/1120	JUN 22	m reor./spin trim/alt. reduct.
177/0327	JUN 26	m reor.
187/1740	JUL 06	m reor.
194/0325	JUL 13	m reor.
205/2220	JUL 24	m period trim
206/0425	JUL 25	m spin trim/reor.
216/0632	AUG 04	m reor.
255/0430	SEP 12	m reor./spin trim/alt. reduct.
256/2254	SEP 13	m spin trim
258/0455	SEP 15	m reor.
260/2312	SEP 17	m period trim/spin trim
262/0350	SEP 19	m reor./spin trim/alt. reduct.
269/0440	SEP 26	m reor./spin trim/alt. reduct.
276/0550	OCT 03	m reor.
277/0134	OCT 04	m spin trim/alt. reduction
283/1354	OCT 10	m reor.



284/0223	OCT 11	m	spin trim/alt. reduction
292/1650	OCT 19	m	reor.
305/1705	NOV 01	m	reor.
318/2001	NOV 14	m	reor.
324/1957	NOV 20	m	reor.
338/1948	DEC 04	m	reor./spin trim
345/2123	DEC 11	m	alt. reduction/spin trim
352/2120	DEC 18	m	alt. reduction/spin trim
362/0016	DEC 28	m	reor.
362/0744	DEC 28	m	alt. reduction/spin trim
80/003/2116	JAN 03	m	alt. reduct./spin trim/reor.
008/2106	JAN 08	m	alt. reduction/spin trim
009/0659	JAN 09	m	period trim/spin trim
015/2200	JAN 15	m	spin trim/alt. reduction
022/2200	JAN 22	m	reor./spin trim/alt. reduct.
029 2215	JAN 29	m	reor.
030/0815	JAN 30	m	alt. reduction/spin trim
037/0830	FEB 06	m	period trim
038/1950	FEB 07	m	reor.
039/0818	FEB 08	m	spin trim
059/2215	FEB 28	m	reor.
074/2345	MAR 14	m	reor./spin trim
093/0150	APR 02	m	reor./alt. reduct./spin trim
101/0035	APR 10	m	spin trim/alt. reduction
107/0100	APR 16	m	alt. reduct./spin trim/reor.
114/0050	APR 23	m	spin trim/alt. reduction
121/0030	APR 30	m	reor./spin trim/alt. reduct.
128/1007	MAY 07	m	spin trim/alt. reduction
134/2330	MAY 13	m	reor./spin trim/alt. reduct.
135/0932	MAY 14	m	period trim/spin trim
141/0930	MAY 20	m	reor./spin trim/alt. reduct.
142/0940	MAY 21	m	period trim/spin trim
155/2120	JUN 03	m	reor. (special)
164/2100	JUN 12	m	reor.
171/2230	JUN 19	m	reor.
179/0130	JUN 27	m	reor./spin trim
192/1428	JUL 10	m	spin trim 6 sec
195/1440	JUL 13	m	spin trim 12 sec
210/2300	JUL 28	m	reor./spin trim
269/1813	SEP 25	m	spin trim
328/0115	NOV 23	m	reor.
346/1722	DEC 11	m	reor.
81/006/0310	JAN 06	m	reor.
036/0450	FEB 05	m	period trim
036/1142	FEB 05	m	reor./spin trim
037/0315	FEB 06	m	period trim
037 1920	FEB 06	m	reor./spin trim
057/0500	FEB 26	m	reor.
076/0700	MAR 17	m	spin trim/reor.
114/0100	APR 24	m	reor.
127/0207	MAY 07	m	period trim
127/2215	MAY 07	m	reor.
141/0208	MAY 21	m	spin trim
142/0208	MAY 22	m	spin trim
148/0207	MAY 28	m	reor.
168/0630	JUN 17	m	reor./spin trim
203/0715	JUL 22	m	reor./spin trim (error)
204/0745	JUL 23	m	reor./spin trim (correct)

238/2015	AUG 26	m	reor./spin trim
268/0830	SEP 25	m	reor./spin trim
336/0152	DEC 02	m	spin trim
363/0820	DEC 29	m	reor./spin trim
82/020/0630	JAN 20	m	reor.
034/0645	FEB 03	m	reor./spin trim
061/0740	MAR 02	m	reor.
097/0144	APR 07	m	spin trim
133/0730	MAY 13	m	spin trim/reor.
176/0720	JUN 25	m	spin trim/reor.
222/0700	AUG 10	m	reor.
252/0620	SEP 09	m	reor.
296/0125	OCT 23	m	reor.
325/0630	NOV 21	m	reor.
343/0615	DEC 09	m	reor.

# **Cycle 4 data arcs:**

15-SEP-92 03:00	15-SEP-92 22:25	27-NOV-92 14:25	28-NOV-92 19:20
15-SEP-92 22:45	17-SEP-92 03:30	28-NOV-92 19:40	30-NOV-92 13:20
17-SEP-92 03:50	18-SEP-92 11:40	30-NOV-92 13:40	01-DEC-92 18:35
18-SEP-92 12:00	19-SEP-92 20:10	01-DEC-92 18:55	03-DEC-92 18:00
19-SEP-92 20:30	20-SEP-92 18:45	03-DEC-92 22:40	04-DEC-92 21:00
20-SEP-92 19:00	21-SEP-92 20:50	04-DEC-92 21:25	06-DEC-92 02:20
21-SEP-92 21:10	22-SEP-92 19:40	06-DEC-92 02:40	07-DEC-92 07:20
22-SEP-92 20:00	23-SEP-92 18:45	07-DEC-92 07:40	08-DEC-92 12:25
23-SEP-92 19:00	24-SEP-92 17:15	08-DEC-92 12:45	09-DEC-92 14:20
24-SEP-92 17:30	25-SEP-92 22:00	09-DEC-92 14:45	10-DEC-92 19:35
25-SEP-92 22:15	27-SEP-92 03:15	10-DEC-92 19:55	12-DEC-92 00:40
27-SEP-92 03:30	28-SEP-92 18:00	12-DEC-92 01:00	12-DEC-92 23:20
28-SEP-92 18:25	30-SEP-92 02:40	12-DEC-92 23:40	14-DEC-92 14:10
30-SEP-92 03:00	01-OCT-92 17:25	14-DEC-92 14:30	15-DEC-92 12:50
01-OCT-92 17:45	02-OCT-92 19:40	15-DEC-92 13:10	17-DEC-92 00:30
02-OCT-92 19:45	03-OCT-92 18:15	17-DEC-92 00:55	17-DEC-92 23:10
03-OCT-92 18:15	05-OCT-92 01:10	17-DEC-92 23:30	19-DEC-92 01:00
05-OCT-92 01:30	06-OCT-92 01:15	19-DEC-92 01:25	19-DEC-92 23:50
06-OCT-92 01:40	06-OCT-92 23:45	20-DEC-92 00:10	21-DEC-92 11:20
07-OCT-92 00:10	08-OCT-92 02:00	21-DEC-92 11:45	23-DEC-92 05:00
08-OCT-92 02:15	09-OCT-92 10:25	23-DEC-92 15:30	25-DEC-92 03:00
09-OCT-92 10:45	11-OCT-92 01:50	26-DEC-92 01:55	27-DEC-92 00:10
11-OCT-92 02:00	12-OCT-92 19:20	27-DEC-92 00:30	27-DEC-92 23:00
12-OCT-92 19:20	13-OCT-92 18:30	27-DEC-92 23:15	29-DEC-92 00:50
13-OCT-92 18:50	14-OCT-92 17:30	29-DEC-92 01:10	31-DEC-92 00:00
14-OCT-92 17:45	15-OCT-92 22:00	01-JAN-93 00:15	02-JAN-93 21:10
15-OCT-92 22:25	17-OCT-92 00:00	02-JAN-93 21:30	03-JAN-93 23:10
17-OCT-92 00:30	18-OCT-92 11:50	03-JAN-93 23:30	05-JAN-93 01:10
18-OCT-92 12:05	19-OCT-92 10:30	05-JAN-93 01:25	06-JAN-93 16:00
19-OCT-92 10:45	20-OCT-92 18:50	06-JAN-93 16:15	07-JAN-93 21:10
20-OCT-92 19:10	21-OCT-92 17:30	07-JAN-93 21:30	08-JAN-93 23:10
21-OCT-92 17:55	23-OCT-92 02:00	08-JAN-93 23:25	09-JAN-93 18:20
23-OCT-92 02:15	24-OCT-92 19:50	09-JAN-93 18:45	11-JAN-93 12:20
24-OCT-92 20:05	26-OCT-92 01:10	11-JAN-93 12:45	12-JAN-93 14:15
26-OCT-92 01:25	27-OCT-92 06:20	12-JAN-93 14:45	14-JAN-93 04:20
27-OCT-92 06:40	29-OCT-92 00:30	14-JAN-93 15:15	15-JAN-93 17:00
29-OCT-92 00:50	30-OCT-92 21:50	15-JAN-93 17:15	16-JAN-93 19:00
30-OCT-92 22:10	31-OCT-92 16:45	16-JAN-93 19:15	17-JAN-93 17:30
31-OCT-92 17:40	02-NOV-92 11:25	17-JAN-93 17:45	19-JAN-93 01:00
02-NOV-92 11:45	04-NOV-92 05:35	19-JAN-93 02:15	20-JAN-93 03:40
04-NOV-92 05:55	05-NOV-92 20:20	20-JAN-93 04:00	21-JAN-93 12:10
05-NOV-92 20:40	07-NOV-92 16:00	21-JAN-93 12:30	22-JAN-93 20:40
07-NOV-92 18:00	08-NOV-92 19:50	22-JAN-93 21:00	23-JAN-93 18:15
08-NOV-92 20:10	10-NOV-92 07:20	23-JAN-93 19:30	24-JAN-93 14:30
10-NOV-92 07:40	11-NOV-92 19:05	24-JAN-93 15:00	25-JAN-93 20:00
11-NOV-92 19:25	13-NOV-92 00:10	25-JAN-93 20:15	27-JAN-93 01:00
13-NOV-92 00:30	14-NOV-92 11:50	27-JAN-93 01:15	27-JAN-93 17:15
14-NOV-92 12:10	16-NOV-92 11:10	27-JAN-93 17:30	28-JAN-93 22:10
16-NOV-92 12:45	17-NOV-92 07:45	28-JAN-93 22:30	29-JAN-93 16:45
17-NOV-92 08:10	18-NOV-92 16:20	29-JAN-93 18:00	30-JAN-93 19:40
18-NOV-92 16:40	19-NOV-92 21:20	30-JAN-93 20:00	31-JAN-93 21:25
19-NOV-92 21:40	21-NOV-92 15:30	31-JAN-93 21:45	01-FEB-93 20:10
21-NOV-92 15:55	23-NOV-92 00:00	01-FEB-93 20:30	02-FEB-93 22:10
23-NOV-92 00:15	24-NOV-92 23:20	02-FEB-93 22:30	03-FEB-93 20:40
25-NOV-92 00:55	26-NOV-92 15:20	03-FEB-93 21:00	04-FEB-93 16:10
26-NOV-92 15:45	27-NOV-92 14:00	04-FEB-93 16:30	05-FEB-93 18:10
		05-FEB-93 18:30	06-FEB-93 16:40
		06-FEB-93 17:00	07-FEB-93 18:40

07-FEB-93 19:00	08-FEB-93 17:10	13-APR-93 13:15	14-APR-93 07:30
08-FEB-93 17:45	09-FEB-93 19:10	14-APR-93 08:45	15-APR-93 10:10
09-FEB-93 19:30	10-FEB-93 21:00	15-APR-93 10:30	16-APR-93 05:40
10-FEB-93 21:30	11-FEB-93 20:00	16-APR-93 06:00	17-APR-93 07:45
11-FEB-93 20:15	13-FEB-93 04:15	17-APR-93 08:00	18-APR-93 09:15
13-FEB-93 04:30	14-FEB-93 02:00	18-APR-93 09:45	19-APR-93 08:00
14-FEB-93 03:15	15-FEB-93 17:20	19-APR-93 08:30	20-APR-93 10:00
15-FEB-93 18:00	16-FEB-93 23:00	20-APR-93 10:15	21-APR-93 18:20
16-FEB-93 23:15	17-FEB-93 11:45	21-APR-93 18:45	22-APR-93 14:00
17-FEB-93 12:00	18-FEB-93 13:30	22-APR-93 14:15	23-APR-93 14:45
18-FEB-93 14:00	19-FEB-93 12:20	23-APR-93 16:00	24-APR-93 16:45
19-FEB-93 12:45	20-FEB-93 13:30	24-APR-93 18:00	25-APR-93 18:30
20-FEB-93 14:30	21-FEB-93 13:00	25-APR-93 19:45	26-APR-93 17:15
21-FEB-93 13:15	22-FEB-93 11:30	26-APR-93 18:30	27-APR-93 20:00
22-FEB-93 12:00	23-FEB-93 16:30	27-APR-93 20:30	29-APR-93 07:40
23-FEB-93 17:00	24-FEB-93 08:00	29-APR-93 08:00	30-APR-93 19:15
24-FEB-93 09:15	25-FEB-93 11:00	30-APR-93 19:45	01-MAY-93 17:45
25-FEB-93 11:15	26-FEB-93 12:30	01-MAY-93 18:15	02-MAY-93 20:00
26-FEB-93 13:00	27-FEB-93 18:00	02-MAY-93 20:15	03-MAY-93 22:00
27-FEB-93 18:15	28-FEB-93 13:15	03-MAY-93 22:00	04-MAY-93 20:15
28-FEB-93 13:45	01-MAR-93 11:45	04-MAY-93 20:45	05-MAY-93 18:30
01-MAR-93 12:15	02-MAR-93 09:45	05-MAY-93 19:30	06-MAY-93 20:00
02-MAR-93 11:00	03-MAR-93 12:30	06-MAY-93 21:15	07-MAY-93 19:30
03-MAR-93 13:00	04-MAR-93 11:00	07-MAY-93 20:00	09-MAY-93 07:10
04-MAR-93 11:30	05-MAR-93 16:15	09-MAY-93 07:30	10-MAY-93 05:00
05-MAR-93 16:45	06-MAR-93 11:30	10-MAY-93 06:15	11-MAY-93 11:00
06-MAR-93 12:00	07-MAR-93 12:45	11-MAY-93 11:15	12-MAY-93 05:30
07-MAR-93 14:00	08-MAR-93 11:45	12-MAY-93 06:45	13-MAY-93 08:10
08-MAR-93 12:45	09-MAR-93 14:15	13-MAY-93 08:30	14-MAY-93 16:30
09-MAR-93 14:30	11-MAR-93 05:15	14-MAY-93 17:00	15-MAY-93 14:15
11-MAR-93 05:30	12-MAR-93 16:15	15-MAY-93 15:30	16-MAY-93 16:15
12-MAR-93 17:00	13-MAR-93 15:20	16-MAY-93 17:30	18-MAY-93 04:45
13-MAR-93 15:45	15-MAR-93 09:20	18-MAY-93 05:00	19-MAY-93 06:30
15-MAR-93 09:45	17-MAR-93 00:15	19-MAY-93 07:00	20-MAY-93 12:20
17-MAR-93 00:45	17-MAR-93 16:20	20-MAY-93 12:40	21-MAY-93 16:45
17-MAR-93 17:00	18-MAR-93 18:15	21-MAY-93 17:15	22-MAY-93 15:15
18-MAR-93 18:45	20-MAR-93 16:00	22-MAY-93 15:45	23-MAY-93 10:00
20-MAR-93 16:15	22-MAR-93 00:10	23-MAY-93 11:15	24-MAY-93 06:15
22-MAR-93 00:30	23-MAR-93 08:40	24-MAY-93 06:45	24-MAY-93 21:30
23-MAR-93 09:00	24-MAR-93 13:15		
24-MAR-93 14:00	25-MAR-93 15:40		
25-MAR-93 16:00	27-MAR-93 03:10		
27-MAR-93 03:30	28-MAR-93 14:45		
28-MAR-93 15:15	29-MAR-93 13:15		
29-MAR-93 13:45	31-MAR-93 04:30		
31-MAR-93 04:45	01-APR-93 12:45		
01-APR-93 13:00	02-APR-93 14:40		
02-APR-93 15:00	03-APR-93 13:15		
03-APR-93 13:45	04-APR-93 15:10		
04-APR-93 15:30	05-APR-93 14:00		
05-APR-93 14:15	06-APR-93 12:20		
06-APR-93 12:45	07-APR-93 14:30		
07-APR-93 14:45	08-APR-93 13:15		
08-APR-93 13:30	09-APR-93 21:30		
09-APR-93 21:45	10-APR-93 13:40		
10-APR-93 14:00	11-APR-93 12:30		
11-APR-93 12:45	12-APR-93 07:30		
12-APR-93 08:00	13-APR-93 13:00		

# **Cycle 5 and 6 data arcs:**

06-AUG-93 00:15 06-AUG-93 20:45  
 07-AUG-93 10:00 08-AUG-93 01:00  
 08-AUG-93 09:00 08-AUG-93 16:45  
 08-AUG-93 18:30 09-AUG-93 02:15  
 09-AUG-93 12:15 09-AUG-93 22:40  
 10-AUG-93 11:30 10-AUG-93 19:15  
 12-AUG-93 13:50 13-AUG-93 03:45  
 14-AUG-93 11:50 15-AUG-93 03:10  
 16-AUG-93 11:50 16-AUG-93 17:40  
 17-AUG-93 12:00 18-AUG-93 00:30  
 18-AUG-93 12:20 18-AUG-93 23:20  
 19-AUG-93 20:00 20-AUG-93 00:35  
 20-AUG-93 11:40 21-AUG-93 00:50  
 21-AUG-93 04:20 21-AUG-93 17:35  
 22-AUG-93 04:00 22-AUG-93 08:15  
 22-AUG-93 13:25 23-AUG-93 06:30  
 23-AUG-93 21:00 24-AUG-93 07:40  
 24-AUG-93 12:40 25-AUG-93 00:15  
 25-AUG-93 20:00 26-AUG-93 16:25  
 27-AUG-93 08:10 28-AUG-93 00:05  
 28-AUG-93 03:45 28-AUG-93 07:50  
 28-AUG-93 17:40 29-AUG-93 16:40  
 30-AUG-93 02:20 30-AUG-93 08:30  
 30-AUG-93 19:40 31-AUG-93 11:15  
 01-SEP-93 03:40 01-SEP-93 18:35  
 01-SEP-93 22:00 02-SEP-93 17:50  
 02-SEP-93 18:00 03-SEP-93 12:10  
 03-SEP-93 14:45 04-SEP-93 00:30  
 04-SEP-93 04:00 05-SEP-93 00:00  
 05-SEP-93 03:50 05-SEP-93 17:30  
 06-SEP-93 04:00 06-SEP-93 16:30  
 07-SEP-93 03:50 08-SEP-93 00:00  
 08-SEP-93 04:10 08-SEP-93 23:40  
 09-SEP-93 04:00 10-SEP-93 00:00  
 10-SEP-93 04:00 10-SEP-93 23:40  
 11-SEP-93 03:30 12-SEP-93 00:00  
 12-SEP-93 04:00 12-SEP-93 17:30  
 12-SEP-93 19:10 13-SEP-93 06:30  
 13-SEP-93 06:00 14-SEP-93 01:20  
 14-SEP-93 04:20 14-SEP-93 23:30  
 15-SEP-93 00:50 15-SEP-93 18:00  
 16-SEP-93 00:30 16-SEP-93 21:10  
 17-SEP-93 11:55 18-SEP-93 08:10  
 18-SEP-93 20:15 19-SEP-93 15:30  
 19-SEP-93 21:30 20-SEP-93 07:00  
 20-SEP-93 21:20 21-SEP-93 14:40  
 22-SEP-93 01:45 22-SEP-93 15:00  
 23-SEP-93 01:15 23-SEP-93 23:00  
 24-SEP-93 02:40 24-SEP-93 23:00  
 25-SEP-93 05:00 25-SEP-93 16:30  
 25-SEP-93 18:30 26-SEP-93 12:00  
 26-SEP-93 16:00 27-SEP-93 07:00  
 27-SEP-93 07:00 27-SEP-93 16:30  
 27-SEP-93 19:30 28-SEP-93 16:30  
 # Periapse raise maneuver  
 # Sept 28 17:18

28-SEP-93 19:30 29-SEP-93 16:30  
 29-SEP-93 19:30 30-SEP-93 16:00  
 01-OCT-93 05:00 01-OCT-93 22:00  
 02-OCT-93 04:00 02-OCT-93 22:30  
 03-OCT-93 00:45 03-OCT-93 16:30  
 03-OCT-93 19:30 04-OCT-93 07:00  
 04-OCT-93 07:00 04-OCT-93 17:45  
 04-OCT-93 19:40 05-OCT-93 16:10  
 05-OCT-93 20:45 06-OCT-93 12:45  
 # Bistatic radar Oct 6, 12h to 22h  
 07-OCT-93 01:15 08-OCT-93 00:00  
 08-OCT-93 00:45 08-OCT-93 22:15  
 09-OCT-93 05:25 10-OCT-93 03:10  
 10-OCT-93 05:30 10-OCT-93 16:00  
 10-OCT-93 19:00 11-OCT-93 07:00  
 11-OCT-93 07:00 11-OCT-93 22:00  
 12-OCT-93 06:00 12-OCT-93 23:50  
 13-OCT-93 02:30 13-OCT-93 16:05  
 14-OCT-93 02:00 14-OCT-93 22:20  
 15-OCT-93 01:10 15-OCT-93 22:50  
 16-OCT-93 01:25 16-OCT-93 22:50  
 17-OCT-93 01:00 17-OCT-93 13:40  
 17-OCT-93 15:10 18-OCT-93 07:00  
 18-OCT-93 19:45 19-OCT-93 16:50  
 20-OCT-93 01:00 20-OCT-93 15:40  
 21-OCT-93 02:50 21-OCT-93 21:35  
 22-OCT-93 13:30 23-OCT-93 07:45  
 23-OCT-93 13:30 24-OCT-93 08:00  
 24-OCT-93 13:25 25-OCT-93 07:00  
 # Began to lose lock 25-OCT 16:10  
 # Lost lock from 25-OCT 18:33  
 # to 26-OCT 01:00ish  
 # Medium gain antenna, S-Band only  
 26-OCT-93 03:30 26-OCT-93 15:15  
 26-OCT-93 16:00 27-OCT-93 04:50  
 27-OCT-93 12:00 28-OCT-93 06:20  
 28-OCT-93 13:30 28-OCT-93 23:00  
 # Return to high gain antenna  
 # 28-OCT 23:25  
 28-OCT-93 23:30 29-OCT-93 15:40  
 29-OCT-93 21:10 30-OCT-93 15:30  
 30-OCT-93 18:50 31-OCT-93 09:30  
 31-OCT-93 14:00 01-NOV-93 07:00  
 01-NOV-93 07:15 01-NOV-93 14:05  
 01-NOV-93 19:35 02-NOV-93 09:20  
 02-NOV-93 13:45 03-NOV-93 09:05  
 03-NOV-93 13:50 04-NOV-93 10:50  
 04-NOV-93 13:20 05-NOV-93 01:05  
 05-NOV-93 06:40 06-NOV-93 05:50  
 06-NOV-93 06:45 07-NOV-93 01:25  
 07-NOV-93 02:45 07-NOV-93 22:50  
 08-NOV-93 10:45 09-NOV-93 05:50  
 # Bistatic radar  
 # Nov 9, 8:35 to 11:44  
 09-NOV-93 13:35 10-NOV-93 03:30  
 10-NOV-93 10:05 11-NOV-93 00:20  
 11-NOV-93 00:25 11-NOV-93 15:40  
 11-NOV-93 20:20 12-NOV-93 17:40

12-NOV-93 18:30	13-NOV-93 15:50	05-JAN-94 21:30	06-JAN-94 08:20
13-NOV-93 16:40	14-NOV-93 15:25	27-JAN-94 10:30	28-JAN-94 00:00
14-NOV-93 19:40	15-NOV-93 08:50	28-JAN-94 15:00	29-JAN-94 14:00
15-NOV-93 16:20	16-NOV-93 13:15	30-JAN-94 01:25	30-JAN-94 15:20
16-NOV-93 14:00	17-NOV-93 10:55	31-JAN-94 09:00	31-JAN-94 23:00
17-NOV-93 18:50	18-NOV-93 09:15	01-FEB-94 10:05	02-FEB-94 06:30
# No ramps beginning		02-FEB-94 11:15	03-FEB-94 00:50
# Nov 18, 1993 at 18:55		03-FEB-94 13:10	04-FEB-94 08:10
18-NOV-93 14:25	19-NOV-93 00:35	04-FEB-94 10:30	05-FEB-94 09:50
19-NOV-93 08:25	19-NOV-93 16:00	05-FEB-94 11:45	06-FEB-94 08:00
19-NOV-93 20:50	20-NOV-93 15:00	06-FEB-94 22:30	07-FEB-94 12:20
20-NOV-93 19:25	21-NOV-93 08:40	07-FEB-94 14:10	08-FEB-94 10:17
21-NOV-93 14:00	22-NOV-93 01:10	08-FEB-94 12:10	09-FEB-94 11:30
22-NOV-93 07:15	22-NOV-93 22:50	09-FEB-94 22:50	10-FEB-94 12:45
23-NOV-93 07:25	24-NOV-93 04:15	10-FEB-94 23:55	11-FEB-94 20:30
24-NOV-93 05:05	24-NOV-93 23:05	11-FEB-94 22:10	12-FEB-94 18:50
25-NOV-93 08:00	25-NOV-93 21:10	12-FEB-94 20:15	13-FEB-94 16:25
26-NOV-93 01:20	26-NOV-93 15:15	13-FEB-94 21:30	14-FEB-94 17:50
26-NOV-93 20:10	27-NOV-93 09:20	14-FEB-94 22:30	15-FEB-94 12:30
27-NOV-93 13:35	27-NOV-93 22:50	15-FEB-94 23:50	16-FEB-94 23:05
28-NOV-93 07:45	28-NOV-93 21:45	17-FEB-94 11:05	18-FEB-94 06:50
29-NOV-93 05:05	29-NOV-93 12:15	18-FEB-94 21:00	19-FEB-94 11:35
29-NOV-93 20:40	30-NOV-93 08:40	19-FEB-94 15:40	20-FEB-94 06:20
30-NOV-93 12:20	01-DEC-93 00:15	20-FEB-94 16:45	21-FEB-94 07:00
01-DEC-93 07:40	02-DEC-93 04:50	21-FEB-94 18:20	22-FEB-94 14:30
02-DEC-93 08:30	03-DEC-93 02:45	22-FEB-94 16:30	23-FEB-94 05:40
03-DEC-93 03:30	03-DEC-93 20:00	23-FEB-94 17:40	24-FEB-94 04:30
03-DEC-93 22:25	04-DEC-93 16:30	24-FEB-94 09:20	25-FEB-94 01:40
04-DEC-93 17:20	05-DEC-93 04:50	25-FEB-94 10:30	26-FEB-94 00:30
05-DEC-93 09:00	06-DEC-93 06:20	26-FEB-94 11:40	27-FEB-94 05:00
06-DEC-93 08:00	07-DEC-93 00:00	27-FEB-94 13:00	28-FEB-94 00:00
07-DEC-93 06:20	07-DEC-93 23:30	28-FEB-94 10:50	01-MAR-94 04:15
08-DEC-93 04:30	09-DEC-93 00:20	01-MAR-94 12:05	02-MAR-94 11:00
09-DEC-93 09:00	10-DEC-93 07:35	02-MAR-94 14:00	03-MAR-94 13:10
10-DEC-93 12:10	11-DEC-93 06:15	03-MAR-94 14:15	04-MAR-94 11:00
11-DEC-93 08:35	12-DEC-93 07:20	04-MAR-94 12:20	05-MAR-94 02:50
12-DEC-93 12:30	13-DEC-93 07:25	05-MAR-94 14:15	06-MAR-94 04:00
13-DEC-93 13:00	14-DEC-93 05:20	06-MAR-94 11:40	07-MAR-94 02:00
14-DEC-93 08:50	14-DEC-93 22:30	07-MAR-94 09:45	08-MAR-94 08:30
15-DEC-93 09:00	16-DEC-93 02:20	08-MAR-94 17:20	09-MAR-94 07:30
16-DEC-93 08:30	17-DEC-93 05:50	09-MAR-94 16:00	10-MAR-94 16:20
17-DEC-93 08:30	18-DEC-93 07:05	# Periapse lower maneuvers	
18-DEC-93 12:25	19-DEC-93 08:00	# March 10 16:10:18 and 17:44:35	
19-DEC-93 13:25	20-DEC-93 06:20	10-MAR-94 19:50	11-MAR-94 06:45
20-DEC-93 14:20	21-DEC-93 10:45	11-MAR-94 14:20	12-MAR-94 08:00
21-DEC-93 19:45	22-DEC-93 15:15	12-MAR-94 13:00	13-MAR-94 08:30
22-DEC-93 17:00	23-DEC-93 13:10	13-MAR-94 16:40	14-MAR-94 04:00
23-DEC-93 18:30	24-DEC-93 06:00	14-MAR-94 21:20	15-MAR-94 20:50
25-DEC-93 17:30	26-DEC-93 14:00	15-MAR-94 21:30	16-MAR-94 18:50
26-DEC-93 15:30	27-DEC-93 12:00	17-MAR-94 07:10	18-MAR-94 03:00
27-DEC-93 13:40	28-DEC-93 07:00	18-MAR-94 06:45	19-MAR-94 06:40
28-DEC-93 18:00	29-DEC-93 14:20	19-MAR-94 07:20	20-MAR-94 04:30
29-DEC-93 16:00	30-DEC-93 06:15	20-MAR-94 08:40	21-MAR-94 08:40
30-DEC-93 14:15	31-DEC-93 10:30	21-MAR-94 10:00	22-MAR-94 08:15
01-JAN-94 07:10	02-JAN-94 03:40	22-MAR-94 17:00	23-MAR-94 08:00
02-JAN-94 05:15	03-JAN-94 01:30	24-MAR-94 01:20	24-MAR-94 12:00
03-JAN-94 09:45	04-JAN-94 08:15	24-MAR-94 19:00	25-MAR-94 07:00
04-JAN-94 10:50	05-JAN-94 07:00	25-MAR-94 14:00	26-MAR-94 08:10

26-MAR-94 12:00	27-MAR-94 08:30	17-MAY-94 08:20	18-MAY-94 07:20
27-MAR-94 10:00	28-MAR-94 02:45	18-MAY-94 08:05	19-MAY-94 07:55
28-MAR-94 11:10	29-MAR-94 02:00	19-MAY-94 08:30	20-MAY-94 04:15
29-MAR-94 15:30	30-MAR-94 12:30	20-MAY-94 07:55	21-MAY-94 06:45
30-MAR-94 13:30	31-MAR-94 10:40	21-MAY-94 07:00	22-MAY-94 02:45
31-MAR-94 15:35	01-APR-94 15:25	22-MAY-94 06:05	23-MAY-94 06:30
01-APR-94 17:15	02-APR-94 16:40	23-MAY-94 06:50	24-MAY-94 05:50
02-APR-94 17:15	03-APR-94 17:30	24-MAY-94 06:05	25-MAY-94 05:10
03-APR-94 18:30	04-APR-94 17:40	25-MAY-94 05:25	26-MAY-94 06:00
# Periapse raise on April 4,		26-MAY-94 06:10	27-MAY-94 06:05
# 17:31 and 20:40		27-MAY-94 08:30	28-MAY-94 07:30
04-APR-94 22:26	05-APR-94 13:50	28-MAY-94 07:45	29-MAY-94 06:50
# Apoapse lower on April 5,		29-MAY-94 08:25	30-MAY-94 07:10
# 14:48, 17:57, 21:06		30-MAY-94 12:30	31-MAY-94 11:30
05-APR-94 22:04	06-APR-94 19:40	# Bistatic radar:	
06-APR-94 22:25	07-APR-94 19:00	# May 31, 12:21 to 17:14 (SCET)	
07-APR-94 19:50	08-APR-94 19:40	31-MAY-94 17:50	01-JUN-94 16:50
08-APR-94 23:50	09-APR-94 18:00	01-JUN-94 17:00	02-JUN-94 16:00
09-APR-94 18:40	10-APR-94 16:00	02-JUN-94 16:20	03-JUN-94 15:15
10-APR-94 16:40	11-APR-94 15:00	03-JUN-94 15:30	04-JUN-94 14:30
# Apoapse lower on April 11,		04-JUN-94 15:05	05-JUN-94 13:30
# 14:58, 18:05, 21:12		# Bistatic radar:	
11-APR-94 23:08	12-APR-94 15:50	# Jun 5, 12:57 to 24:20 (SCET)	
# Apoapse lower on April 12,		06-JUN-94 01:00	06-JUN-94 16:10
# 15:53, 19:00, 22:06		06-JUN-94 20:15	07-JUN-94 17:00
13-APR-94 00:39	14-APR-94 00:45	08-JUN-94 01:00	09-JUN-94 00:00
14-APR-94 01:50	15-APR-94 03:00	09-JUN-94 00:30	10-JUN-94 00:30
15-APR-94 15:30	16-APR-94 07:50	10-JUN-94 01:30	11-JUN-94 01:30
16-APR-94 15:40	17-APR-94 08:00	11-JUN-94 02:00	12-JUN-94 02:10
17-APR-94 16:20	18-APR-94 07:10	12-JUN-94 03:00	13-JUN-94 03:00
18-APR-94 11:10	19-APR-94 11:00	13-JUN-94 03:45	14-JUN-94 03:45
19-APR-94 11:50	20-APR-94 11:40	14-JUN-94 04:30	15-JUN-94 04:30
20-APR-94 15:30	21-APR-94 09:30	15-JUN-94 05:15	16-JUN-94 04:50
21-APR-94 10:25	22-APR-94 07:45	16-JUN-94 07:30	17-JUN-94 04:45
22-APR-94 08:55	23-APR-94 07:50	17-JUN-94 06:45	18-JUN-94 04:00
23-APR-94 08:00	24-APR-94 07:45	18-JUN-94 08:50	18-JUN-94 20:55
24-APR-94 08:00	25-APR-94 07:05	19-JUN-94 09:25	20-JUN-94 04:50
25-APR-94 08:00	26-APR-94 08:30	20-JUN-94 09:15	21-JUN-94 04:40
26-APR-94 08:45	27-APR-94 07:50	21-JUN-94 08:50	22-JUN-94 03:30
27-APR-94 10:00	28-APR-94 08:00	22-JUN-94 09:00	22-JUN-94 13:30
28-APR-94 08:30	29-APR-94 07:50	22-JUN-94 15:20	23-JUN-94 15:20
29-APR-94 08:00	30-APR-94 07:45	23-JUN-94 16:05	24-JUN-94 16:05
30-APR-94 09:00	01-MAY-94 07:45	# Bistatic radar:	
01-MAY-94 08:45	02-MAY-94 03:50	# June 24, 17:15 to 23:45	
02-MAY-94 08:00	03-MAY-94 07:50	25-JUN-94 00:35	26-JUN-94 00:35
03-MAY-94 08:10	04-MAY-94 07:10	26-JUN-94 01:25	27-JUN-94 01:25
05-MAY-94 08:10	06-MAY-94 07:15	27-JUN-94 02:10	28-JUN-94 02:10
06-MAY-94 08:40	07-MAY-94 07:50	28-JUN-94 03:20	29-JUN-94 03:00
07-MAY-94 08:10	08-MAY-94 07:15	29-JUN-94 03:50	30-JUN-94 03:50
08-MAY-94 08:00	09-MAY-94 04:10	30-JUN-94 09:00	01-JUL-94 04:35
09-MAY-94 08:15	10-MAY-94 08:50	01-JUL-94 09:45	02-JUL-94 08:35
10-MAY-94 09:00	11-MAY-94 08:00	02-JUL-94 09:05	03-JUL-94 06:15
11-MAY-94 12:30	12-MAY-94 10:20	03-JUL-94 10:00	04-JUL-94 07:00
12-MAY-94 10:35	13-MAY-94 09:30	04-JUL-94 09:20	05-JUL-94 09:20
13-MAY-94 09:55	14-MAY-94 08:50	05-JUL-94 09:50	06-JUL-94 08:30
14-MAY-94 09:10	15-MAY-94 08:00	06-JUL-94 14:00	07-JUL-94 12:20
15-MAY-94 08:15	16-MAY-94 07:00	07-JUL-94 13:00	08-JUL-94 06:30
16-MAY-94 08:00	17-MAY-94 08:00	08-JUL-94 09:20	09-JUL-94 06:30

09-JUL-94 09:50	10-JUL-94 05:30	31-AUG-94 20:00	01-SEP-94 05:30
10-JUL-94 09:40	11-JUL-94 04:30	01-SEP-94 17:50	02-SEP-94 07:15
11-JUL-94 10:15	12-JUL-94 10:10	02-SEP-94 10:15	03-SEP-94 08:15
12-JUL-94 11:00	13-JUL-94 10:55	03-SEP-94 10:30	04-SEP-94 11:00
13-JUL-94 11:45	14-JUL-94 11:50	04-SEP-94 17:20	05-SEP-94 18:45
14-JUL-94 12:20	15-JUL-94 06:30	05-SEP-94 18:45	06-SEP-94 14:20
15-JUL-94 07:00	16-JUL-94 01:05	# Windmill Sep 06 from	
# Bistatic radar:		# 14:26-14:55 (SCET)	
# July 16, 1:00-6		06-SEP-94 15:00	07-SEP-94 15:05
16-JUL-94 09:00	17-JUL-94 04:45	# Windmill Sep 07 from	
17-JUL-94 08:15	18-JUL-94 04:40	# 15:09-15:37 (SCET)	
18-JUL-94 09:40	18-JUL-94 21:20	07-SEP-94 15:45	08-SEP-94 12:45
19-JUL-94 10:00	20-JUL-94 09:15	# Windmill Sep 08 from	
20-JUL-94 13:00	21-JUL-94 12:45	# 12:46-13:15,14:19-14:48 (SCET)	
21-JUL-94 13:00	22-JUL-94 12:00	08-SEP-94 14:55	09-SEP-94 13:25
22-JUL-94 12:30	23-JUL-94 12:45	# Windmill Sep 09 from	
23-JUL-94 13:15	24-JUL-94 13:30	# 13:29-13:57 (SCET)	
24-JUL-94 14:15	25-JUL-94 03:40	09-SEP-94 14:05	10-SEP-94 13:45
25-JUL-94 10:15	26-JUL-94 04:30	10-SEP-94 13:45	11-SEP-94 14:30
26-JUL-94 10:30	26-JUL-94 21:20	11-SEP-94 14:30	12-SEP-94 15:30
27-JUL-94 04:20	28-JUL-94 01:20	# Windmill Sep 12 from	
28-JUL-94 09:30	29-JUL-94 08:20	# 15:36-16:05 (SCET)	
29-JUL-94 16:10	30-JUL-94 18:10	12-SEP-94 16:10	13-SEP-94 13:05
30-JUL-94 19:10	31-JUL-94 20:40	# Windmill Sep 13 from	
01-AUG-94 11:00	02-AUG-94 11:10	# 13:13-15:09 (SCET)	
02-AUG-94 12:20	03-AUG-94 12:10	13-SEP-94 15:15	14-SEP-94 13:45
03-AUG-94 13:05	04-AUG-94 12:50	# Windmill Sep 14 from	
04-AUG-94 13:45	05-AUG-94 07:40	# 13:51-17:30 (SCET)	
05-AUG-94 10:00	06-AUG-94 07:45	14-SEP-94 17:35	15-SEP-94 16:30
06-AUG-94 10:00	07-AUG-94 07:50	15-SEP-94 17:00	16-SEP-94 17:10
07-AUG-94 10:45	08-AUG-94 08:30	16-SEP-94 17:45	17-SEP-94 17:55
08-AUG-94 10:10	09-AUG-94 12:15	17-SEP-94 18:25	18-SEP-94 18:25
# Bistatic radar:		18-SEP-94 19:00	19-SEP-94 22:15
# Aug 9, 13:30-20:30		19-SEP-94 23:00	21-SEP-94 00:20
09-AUG-94 20:50	10-AUG-94 16:05	21-SEP-94 11:50	22-SEP-94 15:10
11-AUG-94 00:15	12-AUG-94 03:45	22-SEP-94 15:45	23-SEP-94 15:50
12-AUG-94 10:15	13-AUG-94 13:45	23-SEP-94 16:10	24-SEP-94 16:30
13-AUG-94 14:10	14-AUG-94 17:45	24-SEP-94 16:50	25-SEP-94 17:10
15-AUG-94 10:20	16-AUG-94 04:00	25-SEP-94 17:50	26-SEP-94 17:30
16-AUG-94 10:20	17-AUG-94 06:15	26-SEP-94 19:15	27-SEP-94 18:40
17-AUG-94 13:25	18-AUG-94 14:40	27-SEP-94 19:10	28-SEP-94 16:50
18-AUG-94 14:55	19-AUG-94 17:00	# Lower periapse	
19-AUG-94 17:15	20-AUG-94 23:15	# 28-SEP 16:49 and 18:21	
21-AUG-94 10:20	22-AUG-94 02:30	28-SEP-94 19:50	29-SEP-94 19:50
22-AUG-94 10:30	23-AUG-94 02:30	29-SEP-94 20:30	30-SEP-94 20:30
23-AUG-94 10:30	24-AUG-94 02:30	30-SEP-94 21:00	01-OCT-94 21:15
24-AUG-94 10:00	25-AUG-94 02:30	01-OCT-94 21:40	02-OCT-94 21:45
25-AUG-94 10:00	25-AUG-94 17:30	02-OCT-94 22:15	03-OCT-94 22:45
# Lower periapse for windmill		04-OCT-94 11:20	05-OCT-94 09:00
# Aug 25, 17:32, 19:05		05-OCT-94 13:15	06-OCT-94 15:00
25-AUG-94 19:15	26-AUG-94 08:00	06-OCT-94 15:30	07-OCT-94 17:40
26-AUG-94 10:00	27-AUG-94 06:30	07-OCT-94 19:15	08-OCT-94 21:45
27-AUG-94 10:20	28-AUG-94 13:45	08-OCT-94 23:00	09-OCT-94 22:30
28-AUG-94 13:50	29-AUG-94 14:30	10-OCT-94 12:00	11-OCT-94 13:00
29-AUG-94 14:35	30-AUG-94 15:10	# Termination maneuvers:	
# Windmill Aug 30 from		# 11-OCT-94	
# 15:35-16:04,17:09-17:37 (SCET)		# 14:21,15:53,17:25,18:57,22:01	
30-AUG-94 18:20	31-AUG-94 18:30		



# **Magellan cycle 4 hide history.**

First time is hide sequence epoch:

HA = Time past periapse of first hide, HH:MM:SS

LA = Length of first hide, HH:MM:SS

HB = Time past periapse of second hide, HH:MM:SS

LB = Length of second hide, HH:MM:SS

```
-----
14-SEP-1992 04:55    HA=01:51:00 LA=00:20:00
25-SEP-1992 16:30    HA=01:41:55 LA=00:25:00
09-OCT-1992 17:31    HA=01:51:25 LA=00:40:00
23-OCT-1992 18:42    HA=01:07:00 LA=00:10:00    HB=02:21:31 LB=00:10:00
06-NOV-1992 19:43    HA=00:47:01 LA=00:40:00    HB=01:54:28 LB=00:40:00
20-NOV-1992 17:27    HA=00:41:00 LA=01:54:00
18-DEC-1992 16:31    HA=00:41:00 LA=00:49:00    HB=01:46:32 LB=00:49:00
15-JAN-1993 17:38    HA=00:41:31 LA=00:35:00    HB=02:00:51 LB=00:35:00
07-MAY-1993 17:06    HA=00:41:00 LA=00:49:00    HB=01:46:30 LB=00:49:00
```

# **Magellan cycle 5&6 hides.**

First time is time of first hide  
on the given day.

L = Length of hide, HH:MM.

N = Time between beginning of  
hides, HH:MM:SS.

```

-----
17-AUG-93 12:25 L=0:20 N=1:35:00
18-AUG-93 13:40 L=0:20 N=1:35:00
19-AUG-93 21:10 L=0:30 N=3:09:00
20-AUG-93 12:53 L=0:30 N=3:09:00
21-AUG-93 04:40 L=0:30 N=3:09:00
22-AUG-93 05:52 L=0:30 N=3:09:00
22-AUG-93 15:18 L=0:30 N=3:09:00
23-AUG-93 22:50 L=0:30 N=3:09:00
24-AUG-93 14:35 L=0:30 N=3:09:00
25-AUG-93 22:05 L=0:30 N=3:09:00
11-NOV-93 22:30 L=1:10 N=3:09:00
12-NOV-93 20:35 L=1:10 N=3:09:00
13-NOV-93 18:39 L=1:10 N=3:09:00
14-NOV-93 19:53 L=1:10 N=3:09:00
15-NOV-93 17:58 L=1:10 N=3:09:00
16-NOV-93 16:02 L=1:10 N=3:09:00
17-NOV-93 20:26 L=1:10 N=3:09:00
18-NOV-93 15:21 L=1:10 N=3:09:00
19-NOV-93 10:16 L=1:10 N=3:09:00
19-NOV-93 22:55 L=1:10 N=3:09:00
20-NOV-93 20:59 L=1:10 N=3:09:00
21-NOV-93 15:55 L=1:10 N=3:09:00
22-NOV-93 07:41 L=1:10 N=3:09:00
23-NOV-93 08:54 L=1:10 N=3:09:00
24-NOV-93 07:02 L=1:10 N=3:09:00
25-NOV-93 08:14 L=1:10 N=3:09:00
26-NOV-93 03:11 L=1:10 N=3:09:00
26-NOV-93 22:06 L=1:10 N=3:09:00
27-NOV-93 13:53 L=1:10 N=3:09:00
28-NOV-93 08:48 L=1:10 N=3:09:00
29-NOV-93 06:53 L=1:10 N=3:09:00
29-NOV-93 22:39 L=1:10 N=3:09:00
30-NOV-93 14:26 L=1:10 N=3:09:00
01-DEC-93 09:21 L=1:10 N=3:09:00
02-DEC-93 10:36 L=1:10 N=3:09:00
03-DEC-93 05:34 L=1:02 N=3:09:00
04-DEC-93 00:29 L=1:02 N=3:09:00
04-DEC-93 19:24 L=1:02 N=3:09:00
05-DEC-93 11:11 L=1:02 N=3:09:00
06-DEC-93 09:12 L=1:02 N=3:09:00
07-DEC-93 07:17 L=1:02 N=3:09:00
08-DEC-93 05:23 L=1:02 N=3:09:00
09-DEC-93 09:47 L=1:02 N=3:09:00
10-DEC-93 14:09 L=1:02 N=3:09:00
11-DEC-93 09:06 L=1:02 N=3:09:00
12-DEC-93 13:28 L=1:02 N=3:09:00
13-DEC-93 14:41 L=1:02 N=3:09:00
14-DEC-93 09:37 L=1:02 N=3:09:00
15-DEC-93 10:51 L=1:02 N=3:09:00

```

```

16-DEC-93 08:11 L=1:10 N=3:09:00
17-DEC-93 09:23 L=1:10 N=3:09:00
18-DEC-93 13:44 L=1:10 N=3:09:00
19-DEC-93 14:59 L=1:10 N=3:09:00
20-DEC-93 16:12 L=1:10 N=3:09:00
21-DEC-93 20:35 L=1:10 N=3:09:00
22-DEC-93 18:40 L=1:10 N=3:09:00
23-DEC-93 19:54 L=1:10 N=3:09:00
25-DEC-93 19:11 L=1:10 N=3:09:00
26-DEC-93 17:16 L=1:10 N=3:09:00
27-DEC-93 15:20 L=1:10 N=3:09:00
28-DEC-93 19:42 L=1:10 N=3:09:00
29-DEC-93 17:47 L=1:10 N=3:09:00
30-DEC-93 15:50 L=1:10 N=3:09:00
01-JAN-94 08:49 L=1:10 N=3:09:00
02-JAN-94 06:54 L=1:10 N=3:09:00
03-JAN-94 11:16 L=1:10 N=3:09:00
04-JAN-94 12:27 L=1:10 N=3:09:00
05-JAN-94 23:10 L=1:10 N=3:09:00
27-JAN-94 12:01 L=0:58 N=3:09:00
28-JAN-94 16:22 L=0:58 N=3:09:00
30-JAN-94 03:01 L=0:58 N=3:09:00
31-JAN-94 10:31 L=0:58 N=3:09:00
01-FEB-94 11:43 L=0:58 N=3:09:00
02-FEB-94 12:56 L=0:58 N=3:09:00
03-FEB-94 14:06 L=0:58 N=3:09:00
04-FEB-94 12:09 L=0:58 N=3:09:00
05-FEB-94 13:21 L=0:58 N=3:09:00
07-FEB-94 00:00 L=0:58 N=3:09:00
07-FEB-94 15:45 L=0:58 N=3:09:00
08-FEB-94 13:48 L=0:58 N=3:09:00
10-FEB-94 00:27 L=0:58 N=3:09:00
11-FEB-94 01:39 L=0:58 N=3:09:00
11-FEB-94 23:42 L=0:58 N=3:09:00
12-FEB-94 21:46 L=0:58 N=3:09:00
13-FEB-94 22:59 L=0:58 N=3:09:00
15-FEB-94 00:11 L=0:58 N=3:09:00
16-FEB-94 01:24 L=0:58 N=3:09:00
17-FEB-94 12:04 L=0:58 N=3:09:00
18-FEB-94 22:43 L=0:58 N=3:09:00
19-FEB-94 17:37 L=0:58 N=3:09:00
20-FEB-94 18:49 L=0:58 N=3:09:00
21-FEB-94 20:00 L=0:58 N=3:09:00
22-FEB-94 18:03 L=0:58 N=3:09:00
23-FEB-94 19:15 L=0:58 N=3:09:00
24-FEB-94 11:00 L=0:58 N=3:09:00
25-FEB-94 12:12 L=0:58 N=3:09:00
26-FEB-94 13:23 L=0:58 N=3:09:00
27-FEB-94 14:35 L=0:58 N=3:09:00
28-FEB-94 12:38 L=0:58 N=3:09:00
01-MAR-94 13:50 L=0:58 N=3:09:00
02-MAR-94 15:02 L=0:58 N=3:09:00
03-MAR-94 16:13 L=0:58 N=3:09:00
04-MAR-94 14:17 L=0:58 N=3:09:00
05-MAR-94 15:28 L=0:58 N=3:09:00
06-MAR-94 13:30 L=0:58 N=3:09:00
07-MAR-94 11:33 L=0:58 N=3:09:00
08-MAR-94 19:03 L=0:58 N=3:09:00

```

09-MAR-94	17:06	L=0:58	N=3:09:00	20-JUN-94	12:00	L=0:25	N=3:06:00
10-MAR-94	21:14	L=0:58	N=3:08:30	21-JUN-94	09:42	L=0:25	N=3:06:00
11-MAR-94	16:04	L=0:58	N=3:08:30	22-JUN-94	10:30	L=0:25	N=3:06:00
12-MAR-94	14:03	L=0:58	N=3:08:30	22-JUN-94	17:24	L=1:05	N=3:06:00
13-MAR-94	18:20	L=0:58	N=3:08:30	23-JUN-94	18:12	L=1:05	N=3:06:00
14-MAR-94	22:37	L=0:58	N=3:08:30	25-JUN-94	02:44	L=1:05	N=3:06:00
15-MAR-94	23:45	L=0:58	N=3:08:30	26-JUN-94	03:31	L=1:05	N=3:06:00
17-MAR-94	10:16	L=0:58	N=3:08:30	27-JUN-94	04:19	L=1:05	N=3:06:00
18-MAR-94	08:16	L=0:58	N=3:08:30	28-JUN-94	05:05	L=1:05	N=3:06:00
19-MAR-94	09:24	L=0:58	N=3:08:30	29-JUN-94	05:52	L=1:05	N=3:06:00
20-MAR-94	10:32	L=0:58	N=3:08:30	30-JUN-94	09:46	L=1:05	N=3:06:00
21-MAR-94	11:40	L=0:58	N=3:08:30	01-JUL-94	10:34	L=1:05	N=3:06:00
22-MAR-94	19:05	L=0:58	N=3:08:30	02-JUL-94	11:20	L=1:05	N=3:06:00
24-MAR-94	02:28	L=0:58	N=3:08:30	03-JUL-94	12:08	L=1:05	N=3:06:00
24-MAR-94	11:40	L=0:58	N=3:08:30	04-JUL-94	09:47	L=1:05	N=3:06:00
25-MAR-94	16:10	L=0:58	N=3:08:30	05-JUL-94	10:35	L=1:05	N=3:06:00
26-MAR-94	14:09	L=0:58	N=3:08:30	06-JUL-94	14:28	L=1:05	N=3:06:00
27-MAR-94	12:06	L=0:58	N=3:08:30	07-JUL-94	15:16	L=1:05	N=3:06:00
28-MAR-94	13:14	L=0:58	N=3:08:30	08-JUL-94	09:51	L=1:05	N=3:06:00
29-MAR-94	17:30	L=0:58	N=3:08:30	09-JUL-94	10:38	L=1:05	N=3:06:00
30-MAR-94	15:30	L=0:58	N=3:08:30	10-JUL-94	11:25	L=1:05	N=3:06:00
31-MAR-94	17:15	L=0:50	N=3:08:30	11-JUL-94	12:13	L=1:05	N=3:06:00
01-APR-94	18:23	L=0:50	N=3:08:30	12-JUL-94	13:01	L=1:05	N=3:06:00
02-APR-94	19:27	L=0:50	N=3:08:30	13-JUL-94	13:48	L=1:05	N=3:06:00
03-APR-94	20:38	L=0:50	N=3:08:30	14-JUL-94	14:46	L=0:55	N=3:06:00
05-APR-94	00:55	L=0:50	N=3:08:30	15-JUL-94	09:19	L=0:55	N=3:06:00
05-APR-94	22:56	L=0:50	N=3:08:30	16-JUL-94	10:06	L=0:55	N=3:06:00
07-APR-94	00:04	L=0:50	N=3:08:30	17-JUL-94	10:53	L=0:55	N=3:06:00
07-APR-94	22:01	L=0:50	N=3:08:30	18-JUL-94	11:40	L=0:55	N=3:06:00
09-APR-94	02:17	L=0:50	N=3:08:30	19-JUL-94	12:27	L=0:55	N=3:06:00
09-APR-94	21:05	L=0:50	N=3:08:30	20-JUL-94	13:15	L=0:55	N=3:06:00
10-APR-94	18:57	L=0:50	N=3:08:30	21-JUL-94	14:02	L=0:55	N=3:06:00
12-APR-94	02:17	L=0:50	N=3:06:00	22-JUL-94	14:49	L=0:55	N=3:06:00
13-APR-94	03:10	L=0:50	N=3:06:00	23-JUL-94	15:36	L=0:55	N=3:06:00
14-APR-94	03:58	L=0:50	N=3:06:00	24-JUL-94	16:23	L=0:55	N=3:06:00
15-APR-94	17:08	L=0:50	N=3:06:00	25-JUL-94	10:58	L=0:55	N=3:06:00
16-APR-94	17:52	L=0:50	N=3:06:00	26-JUL-94	11:46	L=0:55	N=3:06:00
17-APR-94	18:40	L=0:50	N=3:06:00	27-JUL-94	06:22	L=0:55	N=3:06:00
18-APR-94	13:16	L=0:50	N=3:06:00	28-JUL-94	10:15	L=0:55	N=3:06:00
19-APR-94	14:04	L=0:50	N=3:06:00	29-JUL-94	17:14	L=0:55	N=3:06:00
20-APR-94	17:58	L=0:50	N=3:06:00	30-JUL-94	21:07	L=0:55	N=3:06:00
02-JUN-94	19:30	L=0:25	N=3:06:00	01-AUG-94	13:23	L=0:55	N=3:06:00
03-JUN-94	17:10	L=0:25	N=3:06:00	02-AUG-94	14:10	L=0:55	N=3:06:00
04-JUN-94	17:59	L=0:25	N=3:06:00	03-AUG-94	14:57	L=0:55	N=3:06:00
06-JUN-94	04:04	L=0:25	N=3:06:00	15-SEP-94	19:20	L=0:50	N=3:05:00
06-JUN-94	22:40	L=0:25	N=3:06:00	16-SEP-94	20:02	L=0:50	N=3:05:00
08-JUN-94	02:33	L=0:25	N=3:06:00	17-SEP-94	20:44	L=0:50	N=3:05:00
09-JUN-94	03:20	L=0:25	N=3:06:00	18-SEP-94	21:26	L=0:50	N=3:05:00
10-JUN-94	04:07	L=0:25	N=3:06:00	20-SEP-94	01:13	L=0:50	N=3:05:00
11-JUN-94	04:55	L=0:25	N=3:06:00	21-SEP-94	14:15	L=0:50	N=3:05:00
12-JUN-94	05:42	L=0:25	N=3:06:00	22-SEP-94	18:02	L=0:50	N=3:05:00
13-JUN-94	06:30	L=0:25	N=3:06:00	23-SEP-94	18:44	L=0:50	N=3:05:00
14-JUN-94	07:16	L=0:25	N=3:06:00	24-SEP-94	19:26	L=0:50	N=3:05:00
15-JUN-94	08:04	L=0:25	N=3:06:00	25-SEP-94	20:07	L=0:50	N=3:05:00
16-JUN-94	08:51	L=0:25	N=3:06:00	26-SEP-94	20:49	L=0:50	N=3:05:00
17-JUN-94	09:38	L=0:25	N=3:06:00	27-SEP-94	21:30	L=0:50	N=3:05:00
18-JUN-94	10:26	L=0:25	N=3:06:00	28-SEP-94	22:11	L=0:50	N=3:05:00
19-JUN-94	11:12	L=0:25	N=3:06:00	29-SEP-94	22:49	L=0:50	N=3:05:00

30-SEP-94	23:26	L=0:50	N=3:05:00
02-OCT-94	00:03	L=0:50	N=3:05:00
03-OCT-94	00:42	L=0:50	N=3:05:00
04-OCT-94	13:40	L=0:50	N=3:05:00
05-OCT-94	14:18	L=0:50	N=3:05:00
06-OCT-94	18:00	L=0:50	N=3:05:00
07-OCT-94	21:43	L=0:50	N=3:05:00
09-OCT-94	01:26	L=0:50	N=3:05:00
10-OCT-94	14:23	L=0:50	N=3:05:00

# Appendix G

## MGNP90LSAAP Gravity Coefficients to Degree and Order 40

The columns contain the following information (in order):

1. Degree n
2. Order m
3. Normalized  $C_{nm} \times 10^{-10}$  ( $C_{20} = -J_2$ )
4. Normalized  $S_{nm} \times 10^{-10}$
5. Uncertainty of normalized  $C_{nm} \times 10^{-10}$
6. Uncertainty of normalized  $S_{nm} \times 10^{-10}$

The reference radius to use with this gravity field is 6051 km.

The gravitational mass is  $324858.601 \text{ km}^3/\text{s}^2$ .

2	0	-19716.2	.0	7.1	.0	9	2	-2417.0	-1734.8	3.0	2.8
2	1	290.3	142.8	4.7	4.6	9	3	2586.1	139.5	2.7	2.4
2	2	8546.5	-998.9	9.4	9.0	9	4	-1578.9	604.1	2.2	2.1
3	0	7989.9	.0	3.6	.0	9	5	561.5	264.0	1.7	1.7
3	1	23479.0	5393.3	3.6	2.9	9	6	-355.2	-1913.7	1.7	1.7
3	2	-95.0	8095.7	5.1	5.5	9	7	-1915.5	1457.0	1.5	1.5
3	3	-1848.8	2126.4	8.6	8.0	9	8	947.8	1354.5	1.8	1.8
4	0	7152.1	.0	2.7	.0	9	9	2525.7	-34.2	2.7	2.7
4	1	-4587.7	4911.9	2.9	2.6	10	0	-2439.3	.0	3.9	.0
4	2	1264.4	4839.8	2.2	2.1	10	1	-1014.2	772.6	4.0	3.3
4	3	-1744.9	-1173.6	3.1	3.0	10	2	-291.7	-1359.5	3.3	3.2
4	4	1769.2	13762.3	6.5	6.3	10	3	-572.7	677.4	2.9	2.7
5	0	-1419.7	.0	2.8	.0	10	4	3410.5	-593.9	2.5	2.4
5	1	1738.0	4422.0	2.6	2.3	10	5	-2931.5	235.3	2.0	2.0
5	2	786.3	-8674.4	2.4	2.2	10	6	-2042.4	1730.4	1.7	1.7
5	3	5093.4	5547.1	1.9	2.0	10	7	-1620.2	-720.3	1.5	1.6
5	4	3925.1	2382.2	3.4	3.2	10	8	1400.5	1221.9	1.6	1.6
5	5	2549.8	-3702.2	4.6	5.0	10	9	1727.0	-826.9	1.6	1.6
6	0	322.6	.0	2.8	.0	10	10	-431.4	161.0	2.3	2.4
6	1	3939.2	-3380.9	2.6	2.4	11	0	495.4	.0	4.2	.0
6	2	1865.3	2604.9	2.3	2.1	11	1	-2304.6	-717.9	4.4	3.7
6	3	7429.5	-2139.7	2.1	1.9	11	2	1086.7	397.9	3.8	3.5
6	4	-1989.2	2597.1	2.0	1.9	11	3	1097.9	-1224.5	3.4	3.0
6	5	2560.6	-591.0	2.3	2.3	11	4	734.5	1742.7	2.8	2.8
6	6	-282.4	2158.7	4.3	4.1	11	5	-45.3	199.6	2.4	2.4
7	0	-721.5	.0	3.0	.0	11	6	-68.0	1437.2	2.0	2.0
7	1	3059.4	-2777.1	2.9	2.5	11	7	-46.4	-1133.4	1.6	1.6
7	2	1518.7	347.8	2.3	2.2	11	8	399.1	292.6	1.5	1.6
7	3	1669.2	-4501.0	2.1	2.0	11	9	67.9	827.3	1.4	1.5
7	4	-200.3	-876.9	2.1	2.0	11	10	374.7	215.3	1.5	1.5
7	5	316.6	-400.3	1.6	1.7	11	11	1285.9	-1229.9	2.2	2.2
7	6	-66.0	-2794.5	2.3	2.2	12	0	-442.5	.0	4.7	.0
7	7	-1948.6	-4835.3	3.5	3.3	12	1	79.7	-880.8	5.0	4.0
8	0	-4251.3	.0	3.3	.0	12	2	1314.0	-199.1	4.2	3.9
8	1	-203.7	-2618.0	3.2	2.8	12	3	-721.5	-586.7	3.8	3.4
8	2	1627.4	-2328.5	2.7	2.5	12	4	661.1	262.9	3.1	3.1
8	3	3060.7	-53.1	2.2	2.0	12	5	1780.7	-1943.5	2.7	2.8
8	4	-1095.8	825.8	1.9	1.8	12	6	1305.4	848.9	2.3	2.4
8	5	-356.3	-176.5	1.7	1.7	12	7	1075.0	-424.4	1.9	2.0
8	6	-602.3	-2973.3	1.8	1.7	12	8	-1062.3	167.6	1.6	1.7
8	7	-317.6	-854.7	1.9	1.9	12	9	-584.0	23.2	1.4	1.5
8	8	964.4	2957.7	3.1	3.1	12	10	1805.4	-366.0	1.4	1.5
9	0	-2353.1	.0	3.6	.0	12	11	816.9	-2326.3	1.4	1.5
9	1	-978.0	227.7	3.5	3.1	12	12	-1611.1	-470.2	1.9	1.9

13 0	-1645.3	.0	5.2	.0
13 1	-186.7	-535.9	5.6	4.5
13 2	402.4	-1096.7	4.8	4.4
13 3	1054.5	-582.2	4.4	3.9
13 4	-1205.7	-1091.1	3.6	3.6
13 5	1030.6	-1227.8	3.1	3.2
13 6	-474.0	482.9	2.7	2.8
13 7	-27.0	1113.6	2.2	2.3
13 8	-17.2	383.0	1.9	2.0
13 9	148.5	1742.1	1.6	1.6
13 10	326.3	-433.4	1.4	1.4
13 11	-1122.6	-542.4	1.4	1.4
13 12	-683.4	-255.3	1.4	1.4
13 13	864.9	345.1	1.9	1.9
14 0	-330.7	.0	5.8	.0
14 1	-615.2	-1314.3	6.3	4.9
14 2	588.9	-285.2	5.5	4.9
14 3	1492.3	-751.6	5.0	4.4
14 4	283.9	-173.9	4.2	4.2
14 5	-152.0	24.5	3.6	3.8
14 6	140.5	-677.1	3.1	3.2
14 7	-318.8	-549.8	2.6	2.8
14 8	60.8	-789.2	2.2	2.4
14 9	-223.7	-684.3	1.9	2.0
14 10	-71.8	217.3	1.6	1.6
14 11	-1191.1	-676.8	1.5	1.4
14 12	-913.3	490.2	1.4	1.3
14 13	-426.2	-408.3	1.3	1.3
14 14	-426.9	-1284.0	1.6	1.6
15 0	-712.9	.0	6.5	.0
15 1	245.5	652.0	7.0	5.4
15 2	459.9	-815.6	6.2	5.5
15 3	-112.2	567.9	5.7	5.0
15 4	473.0	-765.4	4.8	4.8
15 5	120.1	756.0	4.2	4.4
15 6	-295.3	505.6	3.6	3.9
15 7	383.1	-174.8	3.1	3.3
15 8	625.8	-22.3	2.6	2.8
15 9	-690.0	225.1	2.2	2.3
15 10	-446.1	701.0	1.9	1.9
15 11	118.9	-38.5	1.6	1.6
15 12	5.1	-37.5	1.4	1.4
15 13	485.6	-187.1	1.3	1.3
15 14	68.3	113.2	1.3	1.2
15 15	55.3	-70.5	1.6	1.6
16 0	-16.6	.0	7.2	.0
16 1	-466.6	1067.5	7.9	5.9
16 2	-319.2	797.4	7.1	6.1
16 3	359.5	271.1	6.5	5.7
16 4	551.1	719.7	5.5	5.6
16 5	-957.4	291.6	4.9	5.1
16 6	234.6	525.9	4.2	4.6
16 7	206.8	980.8	3.7	3.9
16 8	2.2	-144.6	3.1	3.4
16 9	-229.1	-846.2	2.7	2.8
16 10	103.5	144.3	2.3	2.2
16 11	327.6	51.5	2.0	2.0
16 12	519.5	-305.5	1.6	1.6
16 13	845.6	690.8	1.4	1.4
16 14	903.4	102.0	1.3	1.3
16 15	115.8	-421.4	1.3	1.2
16 16	-307.0	-1174.2	1.4	1.4
17 0	-287.1	.0	8.0	.0
17 1	-633.4	-672.4	8.9	6.5
17 2	146.0	796.9	8.0	6.8
17 3	-582.5	248.4	7.4	6.3
17 4	-305.7	-345.6	6.2	6.5
17 5	469.6	-694.8	5.7	5.8
17 6	-25.4	607.4	4.9	5.5
17 7	186.0	573.9	4.4	4.7
17 8	-425.8	-10.9	3.8	4.0
17 9	542.6	180.1	3.2	3.4

17 10	108.3	785.5	2.8	2.7
17 11	-484.4	566.3	2.3	2.2
17 12	-642.6	2.3	2.0	1.9
17 13	419.9	515.9	1.6	1.6
17 14	561.7	-233.0	1.4	1.4
17 15	466.9	-1602.1	1.3	1.3
17 16	259.6	-262.0	1.2	1.2
17 17	-789.6	11.1	1.4	1.4
18 0	-286.2	.0	8.9	.0
18 1	162.8	44.0	10.0	7.2
18 2	-51.4	25.3	9.0	7.6
18 3	20.9	-137.7	8.4	7.1
18 4	364.3	-236.5	7.0	7.4
18 5	-12.2	235.2	6.6	6.7
18 6	721.3	342.1	5.7	6.3
18 7	80.6	722.0	5.1	5.7
18 8	81.2	562.7	4.5	4.8
18 9	-344.3	406.0	3.9	4.1
18 10	-93.8	-450.5	3.4	3.3
18 11	247.1	190.9	2.9	2.8
18 12	72.5	803.6	2.3	2.3
18 13	-117.1	369.4	2.0	2.0
18 14	68.2	-699.3	1.6	1.6
18 15	130.5	-233.0	1.4	1.4
18 16	-260.7	-141.1	1.2	1.2
18 17	-70.3	-100.5	1.2	1.2
18 18	194.0	-203.8	1.3	1.2
19 0	122.1	.0	9.9	.0
19 1	502.4	-19.3	11.2	7.9
19 2	-112.4	-472.0	10.1	8.4
19 3	-327.9	-78.3	9.5	8.0
19 4	-502.6	-323.3	8.0	8.4
19 5	389.1	277.5	7.4	7.8
19 6	264.2	561.3	6.8	7.2
19 7	-185.1	-306.1	5.9	6.7
19 8	315.2	-196.6	5.5	5.7
19 9	-317.5	438.3	4.7	4.8
19 10	128.7	-362.0	4.1	4.1
19 11	610.9	-170.0	3.6	3.3
19 12	171.8	-121.8	2.9	2.8
19 13	304.2	-596.0	2.4	2.3
19 14	-184.4	-148.0	2.0	2.0
19 15	231.6	251.5	1.6	1.6
19 16	-246.0	-420.9	1.4	1.4
19 17	-296.7	178.6	1.2	1.2
19 18	394.1	189.3	1.2	1.1
19 19	544.1	-96.2	1.3	1.3
20 0	264.8	.0	11.0	.0
20 1	175.8	274.3	12.7	8.7
20 2	-38.7	-242.4	11.4	9.3
20 3	-189.2	-58.5	10.7	9.0
20 4	-92.6	-158.5	9.1	9.4
20 5	-299.6	-2.5	8.4	9.0
20 6	22.6	294.6	7.8	8.2
20 7	-25.5	-222.1	7.0	7.8
20 8	-134.1	454.0	6.3	6.8
20 9	26.4	422.2	5.7	5.8
20 10	-374.6	-140.0	4.9	4.9
20 11	-92.5	-37.6	4.3	4.1
20 12	-37.0	-34.5	3.6	3.4
20 13	374.8	62.9	3.0	2.9
20 14	-176.4	-5.1	2.4	2.3
20 15	244.7	135.0	2.1	2.1
20 16	-39.0	44.1	1.6	1.6
20 17	-357.8	458.5	1.4	1.4
20 18	285.7	888.3	1.2	1.1
20 19	106.8	-401.0	1.2	1.1
20 20	23.3	-230.6	1.1	1.1
21 0	270.0	.0	12.2	.0
21 1	195.9	114.6	14.1	9.5
21 2	118.7	-206.3	12.8	10.3
21 3	79.0	130.1	12.0	10.1

21	4	-206.8	7.3	10.3	10.6	24	7	31.3	61.1	11.9	13.0
21	5	198.9	169.9	9.5	10.2	24	8	-9.1	183.7	11.4	11.8
21	6	-119.8	534.4	8.9	9.5	24	9	-95.1	-15.3	10.6	11.1
21	7	-218.2	107.0	8.2	8.8	24	10	318.4	-58.3	10.0	9.4
21	8	144.3	134.5	7.5	8.2	24	11	194.7	117.7	8.9	8.3
21	9	539.5	102.6	6.8	6.8	24	12	-326.1	-56.5	7.6	7.2
21	10	147.2	114.6	6.0	5.9	24	13	91.8	-148.5	6.6	6.3
21	11	-244.3	107.8	5.2	4.9	24	14	.4	-159.4	5.6	5.4
21	12	5.9	2.2	4.4	4.2	24	15	-4.3	-183.7	4.6	4.6
21	13	9.5	161.0	3.7	3.6	24	16	-197.3	.7	3.8	3.9
21	14	-549.0	181.4	3.0	2.9	24	17	122.0	-80.3	3.2	3.1
21	15	-219.4	-189.9	2.4	2.4	24	18	245.3	186.2	2.6	2.4
21	16	174.0	-63.7	2.0	2.0	24	19	-113.9	-328.0	2.2	2.1
21	17	-576.0	279.1	1.7	1.7	24	20	43.0	-173.0	1.7	1.6
21	18	163.5	81.0	1.4	1.4	24	21	-438.3	195.9	1.5	1.4
21	19	674.3	-60.5	1.2	1.2	24	22	157.1	173.2	1.1	1.1
21	20	109.9	-51.0	1.1	1.1	24	23	129.5	-191.7	1.1	1.1
21	21	325.6	-345.7	1.2	1.2	24	24	-143.5	153.2	1.0	1.0
22	0	74.2	.0	13.5	.0	25	0	253.0	.0	17.8	.0
22	1	-48.3	-209.3	15.7	10.3	25	1	-136.4	-120.4	21.1	13.3
22	2	118.6	-134.6	14.3	11.4	25	2	-162.0	-257.9	19.3	14.9
22	3	-8.5	428.4	13.4	11.1	25	3	-90.8	31.8	18.2	15.0
22	4	-52.4	-208.7	11.6	11.9	25	4	-18.5	20.5	15.6	16.2
22	5	-90.9	263.5	10.9	11.3	25	5	-205.1	-81.1	15.2	15.3
22	6	-5.0	171.8	9.9	10.9	25	6	-141.9	-183.3	14.2	14.9
22	7	-290.2	-45.8	9.5	10.0	25	7	-40.6	-41.0	13.1	14.7
22	8	577.9	263.3	8.5	9.4	25	8	34.4	-46.9	12.8	13.2
22	9	-208.9	-345.6	8.1	8.1	25	9	395.4	156.4	12.0	12.5
22	10	91.7	-249.0	7.1	6.8	25	10	229.7	-101.4	11.4	11.1
22	11	-462.5	84.0	6.2	5.9	25	11	44.2	-48.2	10.5	9.5
22	12	190.5	189.9	5.4	5.0	25	12	-31.1	-36.1	9.1	8.6
22	13	63.9	364.5	4.5	4.3	25	13	172.9	270.7	7.8	7.4
22	14	-156.0	377.6	3.7	3.6	25	14	231.3	-172.6	6.7	6.5
22	15	-16.5	301.5	3.0	3.0	25	15	-257.6	-243.3	5.7	5.6
22	16	-81.4	83.6	2.4	2.4	25	16	217.8	-141.8	4.7	4.7
22	17	-302.6	-131.9	2.1	2.1	25	17	-87.8	167.7	4.0	3.9
22	18	317.7	.3	1.7	1.6	25	18	-147.6	-262.2	3.3	3.1
22	19	570.9	-422.1	1.5	1.4	25	19	-134.4	-198.0	2.6	2.6
22	20	-26.3	-362.2	1.1	1.1	25	20	-145.1	269.6	2.2	2.1
22	21	81.4	-155.2	1.1	1.1	25	21	15.4	-23.1	1.8	1.7
22	22	2.9	637.5	1.1	1.1	25	22	292.8	117.7	1.4	1.4
23	0	-157.1	.0	14.9	.0	25	23	123.4	-117.3	1.1	1.2
23	1	82.3	92.4	17.4	11.2	25	24	-251.6	-1.3	1.1	1.1
23	2	72.5	49.3	15.9	12.4	25	25	121.5	-102.6	1.0	1.0
23	3	16.0	-133.9	14.9	12.4	26	0	-17.4	.0	19.4	.0
23	4	-124.9	287.3	12.8	13.3	26	1	-264.4	242.9	23.0	14.3
23	5	-110.4	165.2	12.4	12.5	26	2	104.8	-157.4	21.1	16.2
23	6	-349.0	58.9	11.2	12.4	26	3	-.7	8.8	19.9	16.2
23	7	268.1	-144.2	10.7	11.3	26	4	-19.2	-89.7	17.1	17.8
23	8	371.9	278.9	9.9	10.7	26	5	-359.9	-403.5	16.6	16.8
23	9	-227.3	327.8	9.2	9.5	26	6	-128.1	3.2	15.7	16.2
23	10	119.2	14.6	8.6	8.1	26	7	-90.8	-43.3	14.5	16.2
23	11	163.3	128.9	7.4	7.0	26	8	342.8	59.3	14.2	14.9
23	12	-143.8	79.1	6.5	6.1	26	9	142.5	-54.3	13.5	13.7
23	13	-351.3	-113.0	5.5	5.3	26	10	-3.2	-138.0	12.7	12.7
23	14	102.6	108.7	4.5	4.5	26	11	-190.4	-267.9	12.1	11.1
23	15	231.7	-24.7	3.8	3.8	26	12	324.9	161.8	10.5	9.9
23	16	227.8	-117.7	3.1	3.1	26	13	-38.5	11.0	9.2	8.9
23	17	-93.0	24.8	2.5	2.5	26	14	25.5	-134.5	7.9	7.6
23	18	27.1	222.7	2.1	2.0	26	15	68.7	16.9	6.8	6.8
23	19	95.8	-257.6	1.7	1.7	26	16	-23.0	177.3	5.8	5.8
23	20	-34.2	-600.2	1.4	1.4	26	17	133.6	-461.4	4.8	4.8
23	21	114.0	163.0	1.2	1.2	26	18	-251.8	-134.3	4.1	3.9
23	22	-123.6	240.8	1.1	1.1	26	19	238.3	-95.1	3.4	3.2
23	23	339.1	104.0	1.1	1.1	26	20	-222.6	-120.6	2.6	2.6
24	0	33.1	.0	16.3	.0	26	21	169.2	-70.5	2.2	2.2
24	1	-214.5	-196.8	19.3	12.2	26	22	15.6	-27.8	1.7	1.7
24	2	-236.4	-240.9	17.6	13.6	26	23	308.7	356.0	1.5	1.5
24	3	51.5	-225.0	16.5	13.6	26	24	-93.4	-237.7	1.1	1.1
24	4	-168.0	231.4	14.2	14.8	26	25	-20.9	-44.8	1.1	1.1
24	5	-321.1	386.5	13.7	13.8	26	26	-167.4	92.6	1.0	1.0
24	6	-71.0	-268.6	12.6	13.7	27	0	7.8	.0	20.9	.0

27	1	-116.0	149.1	24.9	15.5	29	16	16.2	-19.7	9.5	9.5
27	2	-88.0	-21.6	22.8	17.6	29	17	-29.4	166.4	8.3	8.2
27	3	-250.0	32.1	21.6	17.7	29	18	-85.8	-52.8	7.2	7.1
27	4	102.9	-46.3	18.6	19.2	29	19	161.3	-124.2	6.2	6.1
27	5	-341.9	86.1	18.1	18.3	29	20	-204.8	144.7	5.1	5.0
27	6	-247.9	90.1	17.0	17.7	29	21	27.0	213.5	4.3	4.3
27	7	139.8	-119.7	16.0	17.5	29	22	-65.9	-77.8	3.4	3.5
27	8	128.1	-110.2	15.4	16.7	29	23	71.5	85.9	2.8	2.9
27	9	-14.3	-202.6	15.1	15.0	29	24	-13.4	115.7	2.3	2.3
27	10	-165.7	57.5	14.1	14.2	29	25	21.9	-83.3	1.8	1.9
27	11	210.5	208.1	13.6	12.6	29	26	186.1	79.9	1.5	1.5
27	12	-41.3	140.7	12.3	11.4	29	27	175.2	114.6	1.2	1.2
27	13	-54.8	-31.1	10.6	10.2	29	28	-179.0	-17.3	1.1	1.1
27	14	-149.2	-88.9	9.4	9.0	29	29	202.2	-71.8	.9	.9
27	15	221.0	148.0	8.0	7.9	30	0	85.7	.0	25.4	.0
27	16	42.1	169.0	6.9	6.9	30	1	5.9	34.5	29.9	19.3
27	17	57.7	-14.1	5.9	5.9	30	2	-97.6	-158.3	27.4	21.9
27	18	174.1	83.9	5.0	4.8	30	3	109.0	109.0	26.2	21.7
27	19	346.9	80.9	4.2	4.1	30	4	-53.3	-72.0	22.6	23.9
27	20	-109.7	-166.5	3.3	3.3	30	5	156.5	-133.2	22.4	21.8
27	21	150.5	59.9	2.7	2.7	30	6	10.7	-108.1	21.0	21.5
27	22	23.2	-8.0	2.2	2.2	30	7	-260.5	-.8	19.6	21.2
27	23	206.2	115.9	1.8	1.8	30	8	1.6	12.4	19.0	20.2
27	24	199.3	-191.2	1.5	1.5	30	9	-84.9	-65.3	18.3	19.8
27	25	-383.1	112.4	1.1	1.2	30	10	-27.6	-30.2	18.5	17.9
27	26	91.7	-78.3	1.1	1.1	30	11	-253.5	-112.5	17.5	16.8
27	27	-81.1	-102.8	1.0	1.0	30	12	56.8	51.1	16.5	15.8
28	0	157.9	.0	22.4	.0	30	13	-6.6	87.0	15.4	14.5
28	1	62.1	-51.8	26.8	16.7	30	14	50.5	-1.5	13.8	13.5
28	2	-21.8	-32.3	24.4	18.9	30	15	77.4	-188.4	12.5	12.1
28	3	-57.7	-92.9	23.2	19.2	30	16	-86.7	127.3	10.8	10.8
28	4	-144.2	-206.8	20.0	20.8	30	17	112.6	76.5	9.7	9.6
28	5	-22.6	26.2	19.7	19.5	30	18	-113.7	-154.4	8.4	8.3
28	6	-96.1	88.4	18.4	19.2	30	19	71.9	-69.9	7.3	7.2
28	7	76.8	-153.4	17.4	18.6	30	20	-25.0	158.8	6.2	6.2
28	8	64.8	-40.3	16.5	18.3	30	21	-64.7	124.3	5.2	5.2
28	9	-206.6	-226.2	16.5	16.6	30	22	-106.9	-28.4	4.3	4.4
28	10	154.1	166.9	15.7	15.4	30	23	-25.7	86.7	3.5	3.6
28	11	178.3	245.1	14.8	14.3	30	24	39.0	38.0	2.8	2.9
28	12	-3.9	13.4	13.9	12.8	30	25	192.2	51.5	2.3	2.4
28	13	48.0	44.7	12.3	11.8	30	26	97.5	144.9	1.8	1.8
28	14	21.1	257.5	10.8	10.4	30	27	75.1	-176.5	1.6	1.6
28	15	-81.1	-73.3	9.5	9.3	30	28	88.1	17.5	1.1	1.1
28	16	-45.7	-92.1	8.1	8.1	30	29	68.8	119.6	1.1	1.1
28	17	-119.8	-48.8	7.0	7.0	30	30	67.1	-159.6	.9	.9
28	18	7.6	40.9	6.1	5.9	31	0	57.5	.0	26.6	.0
28	19	-17.2	-140.6	5.1	4.9	31	1	160.2	-57.0	31.1	20.7
28	20	162.1	-122.7	4.2	4.1	31	2	-31.5	-45.7	28.6	23.3
28	21	-34.7	-134.3	3.4	3.4	31	3	-14.8	-10.9	27.4	23.0
28	22	84.5	54.8	2.7	2.8	31	4	39.0	-20.2	23.6	25.2
28	23	-13.3	-23.2	2.3	2.3	31	5	15.8	-119.8	23.7	22.9
28	24	-11.0	29.8	1.7	1.8	31	6	-139.3	-89.8	22.0	22.3
28	25	-360.6	-50.7	1.5	1.5	31	7	-166.8	-107.7	20.6	22.4
28	26	20.7	271.3	1.1	1.1	31	8	-41.4	-18.9	20.0	21.0
28	27	186.8	-206.6	1.1	1.1	31	9	-42.8	-92.2	19.2	20.6
28	28	-34.0	54.9	.9	.9	31	10	-113.1	-40.1	19.3	19.3
29	0	183.4	.0	23.9	.0	31	11	100.0	-50.8	18.8	17.7
29	1	95.2	80.6	28.5	18.0	31	12	15.6	9.3	17.4	17.0
29	2	-231.6	-200.9	26.0	20.4	31	13	-80.0	-5.6	16.6	15.7
29	3	-13.3	151.5	24.8	20.5	31	14	-56.2	-147.8	15.2	14.8
29	4	-142.9	-54.2	21.4	22.3	31	15	-178.2	225.2	13.9	13.5
29	5	16.6	40.2	21.1	20.7	31	16	-150.5	-42.3	12.4	12.3
29	6	-96.5	24.1	19.8	20.5	31	17	-15.8	-69.1	10.9	10.9
29	7	-116.5	-14.0	18.6	19.9	31	18	-25.1	4.1	9.8	9.6
29	8	-29.7	-9.0	17.8	19.4	31	19	-168.6	15.7	8.5	8.4
29	9	-86.6	204.6	17.5	18.3	31	20	46.1	-69.4	7.4	7.2
29	10	180.2	-62.3	17.3	16.6	31	21	-26.3	111.4	6.3	6.3
29	11	-93.4	-52.2	16.1	15.7	31	22	-144.2	118.9	5.2	5.3
29	12	77.6	-127.5	15.4	14.3	31	23	9.7	4.2	4.4	4.5
29	13	72.4	185.4	13.9	13.2	31	24	101.3	-87.8	3.5	3.6
29	14	82.5	69.0	12.4	12.0	31	25	85.7	13.8	2.9	3.0
29	15	16.2	49.0	10.9	10.6	31	26	50.2	-34.8	2.4	2.4



31 27	-8.5	-76.8	1.9	1.9
31 28	71.9	-105.6	1.6	1.5
31 29	101.6	-31.4	1.2	1.2
31 30	-146.7	152.9	1.1	1.1
31 31	75.3	-166.2	.9	.9
32 0	-135.8	.0	27.8	.0
32 1	144.7	94.3	32.2	22.1
32 2	-1.5	10.9	29.4	24.7
32 3	-92.9	-67.4	28.4	24.3
32 4	81.9	105.2	24.4	26.3
32 5	48.4	-31.9	24.8	23.8
32 6	75.9	-43.3	23.0	23.0
32 7	-54.8	5.7	21.2	23.0
32 8	-98.0	-163.6	20.8	22.0
32 9	-87.4	-86.9	20.0	21.1
32 10	-37.9	-87.3	19.6	20.3
32 11	-62.1	183.5	19.8	18.7
32 12	40.1	-63.6	18.5	17.9
32 13	93.4	-14.7	17.5	16.9
32 14	82.0	-43.5	16.4	15.8
32 15	32.6	140.4	15.1	14.8
32 16	-34.3	28.1	13.8	13.5
32 17	102.4	-26.8	12.3	12.3
32 18	-3.3	146.8	10.9	10.8
32 19	-27.7	130.5	9.8	9.7
32 20	25.4	42.5	8.5	8.4
32 21	156.0	65.8	7.4	7.4
32 22	-126.0	17.3	6.3	6.4
32 23	54.6	7.3	5.3	5.3
32 24	110.3	4.0	4.4	4.5
32 25	-158.4	-59.8	3.7	3.7
32 26	61.0	78.2	3.0	2.9
32 27	85.4	-82.8	2.5	2.4
32 28	-146.1	-59.0	1.9	1.8
32 29	-75.7	23.8	1.6	1.6
32 30	-95.4	119.6	1.2	1.2
32 31	170.4	224.8	1.1	1.1
32 32	-289.3	-7.3	.9	.9
33 0	10.5	.0	28.7	.0
33 1	139.2	86.0	32.9	23.4
33 2	26.7	10.5	29.8	26.2
33 3	-49.2	52.3	29.3	25.2
33 4	-32.0	25.8	24.9	27.3
33 5	144.0	38.8	25.6	24.4
33 6	114.0	-7.5	23.9	23.6
33 7	-103.0	-55.0	21.7	23.4
33 8	-127.6	-20.6	21.2	22.6
33 9	-68.9	-65.6	20.6	21.5
33 10	49.3	-186.7	20.0	20.8
33 11	5.6	-14.7	20.1	19.5
33 12	-45.0	-74.7	19.4	18.5
33 13	52.9	35.6	18.1	17.8
33 14	28.5	162.6	17.4	16.6
33 15	164.6	9.6	16.1	15.8
33 16	113.4	-12.4	14.9	14.6
33 17	-125.1	6.8	13.5	13.5
33 18	-114.5	35.4	12.3	12.2
33 19	49.0	5.3	10.9	10.8
33 20	-85.2	-14.0	9.8	9.7
33 21	-111.4	173.6	8.6	8.6
33 22	-4.6	-69.5	7.4	7.5
33 23	57.3	-107.8	6.5	6.5
33 24	36.9	31.6	5.4	5.3
33 25	-134.2	-29.4	4.6	4.5
33 26	-55.1	-17.3	3.7	3.6
33 27	144.4	-159.3	3.1	2.9
33 28	-152.1	-145.9	2.5	2.4
33 29	-53.5	200.5	2.0	1.9
33 30	71.9	105.6	1.6	1.6
33 31	34.6	229.3	1.2	1.2
33 32	-45.4	-10.8	1.1	1.1
33 33	20.0	116.3	.9	.9

34 0	-132.9	.0	29.6	.0
34 1	32.0	-7.2	33.3	24.8
34 2	98.5	4.3	30.0	27.7
34 3	-38.6	10.9	29.9	26.1
34 4	-30.4	92.0	25.3	28.3
34 5	54.8	112.8	26.2	24.8
34 6	8.9	-1.3	24.6	23.9
34 7	-3.5	23.2	22.1	23.8
34 8	-23.9	-15.3	21.5	22.8
34 9	-26.0	150.7	20.9	21.9
34 10	84.8	-40.2	20.4	20.9
34 11	93.2	-145.1	20.1	20.0
34 12	-66.5	-6.7	19.9	19.0
34 13	-46.5	104.3	18.7	18.4
34 14	-62.6	119.1	18.0	17.3
34 15	34.8	-108.6	16.9	16.4
34 16	21.4	-56.2	15.8	15.6
34 17	-12.8	40.6	14.7	14.5
34 18	63.9	-32.3	13.4	13.4
34 19	4.8	-55.4	12.3	12.2
34 20	-68.1	82.9	10.9	10.9
34 21	-16.6	-85.6	9.8	9.8
34 22	102.8	-125.7	8.5	8.7
34 23	-143.7	51.3	7.5	7.6
34 24	-33.8	-34.6	6.5	6.4
34 25	-31.1	41.2	5.5	5.4
34 26	-130.8	151.1	4.7	4.5
34 27	-145.6	23.0	3.9	3.6
34 28	-82.6	-22.1	3.1	2.9
34 29	-45.0	69.0	2.6	2.5
34 30	127.0	-53.8	2.0	1.9
34 31	63.7	127.6	1.7	1.7
34 32	-91.2	88.6	1.2	1.2
34 33	-9.3	106.9	1.1	1.1
34 34	32.3	117.1	.9	.9
35 0	-129.3	.0	30.2	.0
35 1	-24.4	82.5	33.5	26.2
35 2	61.1	6.4	30.1	29.1
35 3	-20.4	79.0	30.3	26.9
35 4	-57.1	-56.7	25.6	29.1
35 5	-.9	36.7	26.8	25.1
35 6	131.0	-43.7	25.0	24.1
35 7	21.5	24.7	22.4	24.1
35 8	47.5	136.9	21.6	22.7
35 9	-42.7	79.1	20.9	22.1
35 10	43.3	-31.5	20.7	20.9
35 11	12.3	-88.1	20.1	20.1
35 12	132.8	-58.3	19.9	19.3
35 13	-26.0	23.9	19.0	18.7
35 14	149.2	-110.3	18.3	17.9
35 15	114.5	-1.9	17.6	16.9
35 16	-82.1	90.3	16.4	16.2
35 17	-51.5	-70.4	15.5	15.3
35 18	72.2	-52.4	14.4	14.4
35 19	73.1	14.5	13.3	13.2
35 20	-59.3	28.3	12.1	12.1
35 21	-13.8	-84.7	10.8	10.9
35 22	-72.4	65.3	9.7	9.9
35 23	-53.7	-63.8	8.6	8.8
35 24	62.9	-5.5	7.6	7.6
35 25	-27.8	10.7	6.6	6.6
35 26	-111.5	122.2	5.7	5.5
35 27	-162.3	-60.3	4.9	4.6
35 28	-46.8	-38.8	4.0	3.8
35 29	64.8	128.8	3.2	3.2
35 30	162.0	-96.6	2.6	2.6
35 31	103.2	-91.9	2.0	2.0
35 32	33.9	33.9	1.7	1.7
35 33	-13.1	38.1	1.2	1.2
35 34	-110.7	-133.3	1.1	1.1
35 35	21.7	42.7	.9	.9
36 0	44.6	.0	31.0	.0

36 1	57.2	-13.8	33.4	27.7	37 36	114.5	-26.0	1.2	1.1
36 2	57.7	11.9	30.0	30.3	37 37	-17.2	-20.1	.9	.9
36 3	-68.8	-167.1	30.6	27.7	38 0	-49.0	.0	32.1	.0
36 4	-103.1	-45.3	25.8	29.7	38 1	-69.8	39.5	33.3	30.1
36 5	43.2	-81.6	27.3	25.3	38 2	45.9	58.3	29.5	32.7
36 6	19.2	21.2	25.4	24.2	38 3	8.0	23.4	31.3	28.7
36 7	16.0	20.6	22.5	24.3	38 4	-82.4	-62.9	26.1	30.9
36 8	99.6	130.2	21.7	22.6	38 5	-24.1	-70.6	28.1	25.8
36 9	-74.4	34.9	20.8	22.0	38 6	6.6	15.3	26.0	24.4
36 10	12.5	-9.9	20.7	20.9	38 7	34.5	-14.6	22.6	24.7
36 11	-61.2	76.1	20.1	19.9	38 8	-75.2	-30.0	22.1	22.4
36 12	44.5	-110.4	19.6	19.4	38 9	-79.1	3.4	20.8	21.5
36 13	27.5	-51.5	19.1	18.8	38 10	11.8	14.1	20.3	20.5
36 14	73.7	-140.3	18.4	18.1	38 11	42.8	-59.9	20.1	19.5
36 15	-25.9	-47.3	17.9	17.2	38 12	-8.7	53.5	19.1	19.2
36 16	1.5	56.3	17.0	16.6	38 13	49.4	89.5	18.6	18.7
36 17	54.1	-65.2	16.0	15.8	38 14	-44.0	159.5	18.3	18.1
36 18	17.2	59.6	15.2	15.1	38 15	8.1	77.9	18.0	17.3
36 19	-75.0	-30.1	14.1	14.2	38 16	-13.2	20.4	17.4	16.9
36 20	38.3	6.7	13.1	13.1	38 17	1.7	104.6	16.6	16.4
36 21	69.0	9.9	12.0	12.1	38 18	8.3	2.7	16.0	15.9
36 22	-122.2	38.6	10.7	10.9	38 19	-7.4	-.9	15.2	15.3
36 23	-15.3	41.8	9.8	9.9	38 20	78.7	-28.2	14.6	14.6
36 24	59.1	.4	8.7	8.8	38 21	-114.1	-23.4	13.7	13.8
36 25	11.3	63.8	7.7	7.8	38 22	-6.7	45.5	12.7	12.9
36 26	-27.6	4.2	6.8	6.6	38 23	7.0	-123.6	11.9	11.9
36 27	8.7	86.6	5.9	5.5	38 24	29.0	1.1	10.8	10.8
36 28	44.7	19.5	5.0	4.7	38 25	-13.0	46.3	9.8	10.0
36 29	48.2	60.5	4.1	4.0	38 26	27.7	71.7	8.9	8.8
36 30	37.2	77.8	3.3	3.2	38 27	15.2	-45.5	8.0	7.7
36 31	2.1	-33.7	2.7	2.7	38 28	.5	75.8	7.0	6.8
36 32	50.2	6.9	2.0	2.1	38 29	161.7	-40.5	6.0	5.9
36 33	95.5	15.7	1.7	1.8	38 30	-88.3	-22.5	5.1	5.1
36 34	-47.3	-172.2	1.2	1.3	38 31	-71.4	-3.7	4.2	4.2
36 35	-1.3	133.8	1.1	1.2	38 32	22.9	-74.7	3.3	3.5
36 36	-85.6	-11.5	.9	.9	38 33	-159.6	32.5	2.8	2.9
37 0	-97.5	.0	31.5	.0	38 34	-7.5	119.6	2.1	2.2
37 1	3.2	12.6	33.4	29.0	38 35	16.0	-48.1	1.8	1.8
37 2	5.8	-73.1	29.7	31.6	38 36	15.0	-16.4	1.3	1.3
37 3	61.1	-15.2	30.9	28.2	38 37	-37.8	93.0	1.2	1.2
37 4	-143.5	-18.3	26.0	30.4	38 38	-80.5	91.5	.9	.9
37 5	-17.7	46.7	27.7	25.4	39 0	-32.2	.0	32.5	.0
37 6	45.6	8.2	25.7	24.3	39 1	-69.0	-11.8	33.3	31.0
37 7	95.1	27.2	22.6	24.4	39 2	74.2	-21.7	29.3	33.7
37 8	-51.4	1.9	21.9	22.6	39 3	16.9	12.1	31.7	29.2
37 9	-37.9	-24.3	20.8	21.7	39 4	74.6	-70.4	26.5	31.3
37 10	19.2	59.2	20.4	20.7	39 5	-7.6	-56.5	28.4	26.1
37 11	-46.5	-84.3	20.2	19.7	39 6	-12.7	-107.0	26.3	24.6
37 12	23.1	77.3	19.3	19.3	39 7	126.3	-43.8	22.7	25.0
37 13	46.0	-40.0	18.9	18.8	39 8	-11.3	106.4	22.4	22.4
37 14	54.2	37.0	18.4	18.2	39 9	-5.7	121.3	20.8	21.5
37 15	-2.8	58.5	18.0	17.4	39 10	-94.6	63.3	20.3	20.4
37 16	34.9	-56.3	17.3	16.8	39 11	.0	71.8	20.0	19.4
37 17	17.7	63.9	16.4	16.2	39 12	12.9	56.3	19.1	19.1
37 18	-144.6	23.3	15.6	15.5	39 13	-57.3	85.6	18.4	18.7
37 19	28.6	-24.4	14.8	14.9	39 14	-27.5	-37.4	18.2	18.0
37 20	15.4	39.2	14.0	13.9	39 15	-8.2	87.9	17.9	17.3
37 21	-36.1	-.4	12.9	13.0	39 16	91.0	93.9	17.4	16.8
37 22	43.8	-60.3	11.9	12.1	39 17	-2.3	70.8	16.7	16.6
37 23	-.3	33.0	10.8	10.9	39 18	72.5	-9.5	16.1	16.1
37 24	107.9	-83.3	9.8	9.9	39 19	-58.9	-24.3	15.5	15.6
37 25	-55.8	48.9	8.8	8.9	39 20	-26.6	-36.1	14.9	15.0
37 26	77.3	-23.1	7.8	7.7	39 21	1.3	-34.3	14.3	14.4
37 27	121.5	65.7	7.0	6.7	39 22	-13.2	47.4	13.4	13.7
37 28	50.5	-8.3	5.9	5.7	39 23	-79.7	-48.1	12.7	12.7
37 29	18.1	-154.8	5.0	5.0	39 24	-63.5	31.1	11.8	11.8
37 30	89.1	-52.6	4.1	4.1	39 25	-22.2	18.2	10.8	10.9
37 31	-4.0	86.6	3.4	3.4	39 26	17.7	-33.3	9.9	9.9
37 32	-17.1	39.4	2.7	2.8	39 27	-91.4	-119.1	9.1	8.8
37 33	43.0	-.9	2.1	2.2	39 28	49.0	-12.7	8.0	7.8
37 34	-91.1	-2.4	1.7	1.8	39 29	69.5	25.7	7.0	7.0
37 35	-131.9	64.7	1.3	1.3	39 30	-64.5	-4.9	6.0	6.0

39 31	-27.3	47.2	5.2	5.2
39 32	-39.4	-39.0	4.2	4.3
39 33	-30.2	18.6	3.5	3.6
39 34	74.9	68.1	2.8	2.9
39 35	67.5	.4	2.2	2.3
39 36	-12.6	55.2	1.8	1.8
39 37	72.1	53.1	1.3	1.3
39 38	69.8	-70.9	1.2	1.2
39 39	-28.6	76.2	.9	.9
40 0	-28.9	.0	32.9	.0
40 1	-1.8	-43.9	33.5	31.7
40 2	-51.1	-36.2	29.2	34.5
40 3	30.4	-6.3	32.0	29.6
40 4	134.9	-.8	27.0	31.5
40 5	72.0	57.7	28.9	26.4
40 6	43.6	-21.0	26.7	25.0
40 7	82.9	-5.6	22.9	25.4
40 8	66.3	15.9	22.7	22.5
40 9	5.6	65.2	21.2	21.5
40 10	-64.0	21.6	20.3	20.4
40 11	-18.1	-21.8	19.9	19.4
40 12	-43.9	-10.4	19.2	19.1
40 13	26.2	33.8	18.3	18.7
40 14	8.2	18.5	18.1	18.0
40 15	90.0	85.2	17.9	17.4
40 16	72.4	13.0	17.4	16.7
40 17	76.2	-79.3	16.8	16.6
40 18	84.7	-17.5	16.2	16.3
40 19	6.7	-52.0	15.7	15.7
40 20	-4.8	-28.1	15.3	15.3
40 21	-52.2	-46.2	14.7	14.7
40 22	-36.9	-18.5	14.0	14.3
40 23	-47.3	55.3	13.4	13.3
40 24	17.0	38.0	12.6	12.5
40 25	63.2	131.0	11.7	11.8
40 26	-90.9	-56.9	10.8	10.8
40 27	-43.2	-22.3	10.1	9.8
40 28	-43.3	-39.6	9.1	8.9
40 29	-30.6	17.5	8.0	8.0
40 30	-56.9	-12.2	7.1	7.2
40 31	23.4	40.8	6.1	6.2
40 32	55.5	96.3	5.2	5.4
40 33	-39.2	44.2	4.3	4.5
40 34	-30.3	-65.7	3.5	3.6
40 35	57.1	-11.7	2.9	3.0
40 36	-34.6	-78.8	2.3	2.2
40 37	75.7	30.8	1.9	1.9
40 38	54.8	-59.6	1.3	1.3
40 39	-50.9	28.3	1.2	1.2
40 40	37.5	51.0	.9	.9



## Appendix H

### Correlations Between Estimated Parameters

The correlations between the nongravity global parameters and the first 5th degree and order coefficients are given in this appendix.

The following names are for the orientation of Venus:

ZACPL2 = Venus pole right ascension in Earth-Mean-Equator of J2000

ZDEPL2 = Venus pole declination in Earth-Mean-Equator of J2000

WDP2 = Venus rotation rate

The following are the Venus (2) and Earth-Moon barycenter (B) Set III parameters from Brouwer and Clemence (1969):

DMW =  $\Delta$  longitude +  $\Delta$  rotation about z-axis (ecliptic north, heliocentric)

EDW = eccentricity \*  $\Delta$  rotation about z-axis

DA =  $\Delta$  semi-major axis / semi-major axis

DE =  $\Delta$  eccentricity

DP =  $\Delta$  rotation about x-axis (p and q give the inclination)

DQ =  $\Delta$  rotation about y-axis

And the rest of the parameters are:

2K2\_2 = Love number of Venus ( $k_2$ )

GM2 = GM of Venus

J20n = Zonal coefficient of degree n

C20n0m =  $C_{nm}$

S20n0m =  $S_{nm}$

ZACFL2	ZDEFL2	WDF2	DMW2	EDW2	DA2	DE2	DF2	DQ2	DMB	EDMB
ZACFL2	1.0	1.0E-01	6.1E-03	1.7E-04	-8.3E-04	2.0E-03	-8.0E-03	3.0E-02	6.8E-03	1.0E-02
ZDEFL2		1.0	-2.9E-03	-6.1E-03	-4.5E-03	-4.4E-03	-2.4E-03	1.0E-02	-2.9E-03	-2.2E-03
WDF2			7.2E-04	-8.0E-03	2.9E-03	-3.2E-03	8.4E-04	5.2E-03	1.1E-03	-9.5E-03
DMW2			1.0	-2.2E-01	8.0E-01	8.6E-02	-2.3E-01	-6.3E-02	1.0	-6.6E-02
EDW2				1.0	-3.8E-01	-1.1E-01	-1.5E-01	-3.5E-02	-2.4E-01	6.4E-01
DA2					1.0	1.4E-01	6.2E-02	-6.5E-02	8.1E-01	-3.8E-01
DE2						1.0	-1.3E-01	-8.5E-03	9.2E-02	5.2E-01
DF2							1.0	8.8E-02	-1.7E-01	-3.8E-01
DQ2								1.0	-2.7E-02	2.1E-02
DMB									1.0	-8.2E-02
EDMB										1.0
DAB	DEB	DFB	DQB	2K2_2	GM2	J202	C20201	S20201	C20202	S20202
ZACFL2	-9.3E-04	6.6E-04	2.2E-02	-3.9E-02	1.1E-02	-1.4E-02	-3.3E-03	1.1E-02	6.5E-02	3.5E-02
ZDEFL2	-4.7E-03	3.6E-03	7.3E-03	4.5E-02	-6.3E-03	-3.4E-02	7.2E-02	4.7E-03	-1.1E-02	4.4E-03
WDF2	3.0E-03	2.0E-03	5.4E-03	3.2E-02	1.8E-02	-1.8E-02	7.8E-02	1.6E-02	-2.2E-02	1.6E-02
DMW2	8.1E-01	2.5E-01	-1.7E-01	1.9E-02	-5.9E-03	-7.5E-03	-1.6E-03	2.9E-02	-2.0E-02	1.5E-02
EDW2	-3.9E-01	-8.2E-01	-1.3E-01	-1.4E-02	4.6E-03	1.7E-02	-4.1E-03	-1.1E-02	1.5E-02	-1.3E-02
DA2	1.0	2.6E-01	-1.7E-02	4.1E-03	-5.8E-03	-4.7E-04	3.2E-03	4.9E-03	-1.4E-02	1.1E-02
DE2	1.5E-01	5.3E-01	-1.2E-02	1.0E-02	1.0E-03	5.3E-03	1.0E-03	-5.5E-02	-2.5E-02	-1.3E-02
DF2	6.9E-02	-1.4E-01	8.6E-01	-3.7E-03	-3.6E-04	2.6E-03	-5.5E-03	-9.1E-03	-6.7E-03	1.0E-02
DQ2	-7.3E-02	5.3E-02	-4.3E-01	2.1E-02	-2.4E-03	6.6E-03	1.5E-02	-2.6E-02	-2.0E-03	-5.8E-03
DMB	8.2E-01	2.5E-01	-1.3E-01	2.0E-02	-5.9E-03	-6.6E-03	1.3E-04	2.8E-02	-2.1E-02	1.6E-02
EDMB	-3.7E-01	-2.1E-01	-1.4E-01	1.4E-02	2.9E-03	6.9E-03	4.8E-04	3.4E-03	-3.1E-03	-7.6E-03
DAB	1.0	2.7E-01	-2.0E-02	4.4E-03	-5.7E-03	1.4E-05	4.6E-03	5.4E-03	-1.4E-02	1.2E-02
DEB		1.0	1.9E-02	2.0E-02	-2.1E-03	-1.0E-02	-3.6E-03	-3.9E-02	-2.9E-02	-1.8E-03
DFB			4.9E-02	-1.5E-02	6.3E-04	-2.0E-03	-1.3E-02	6.2E-03	-4.4E-03	1.2E-02
DQB			1.0	1.7E-02	-2.1E-03	6.7E-03	1.3E-02	-2.6E-02	-4.1E-03	1.2E-02
2K2_2				1.0	1.9E-02	5.9E-02	2.3E-01	7.4E-02	-2.7E-01	7.4E-02
J202						1.0	-6.2E-04	-1.2E-02	-3.2E-03	-3.4E-03
C20201							1.7E-01	1.6E-02	-2.3E-02	1.8E-01
S20201							1.0	2.5E-01	-4.7E-02	4.5E-02
C20202								1.0	-8.3E-02	2.0E-01
S20202									1.0	-1.5E-01

	J203	C20301	S20301	C20302	S20302	C20303	S20303	J204	C20401	S20401	C20402
ZACPL2	4.4E-03	6.8E-03	-1.8E-02	6.9E-02	3.3E-02	1.9E-02	-2.3E-03	-4.2E-03	8.9E-03	4.8E-02	5.1E-02
ZIEFL2	-4.9E-03	-5.9E-02	6.3E-05	2.3E-02	4.3E-03	4.2E-03	-8.1E-03	2.0E-02	-1.3E-02	1.8E-02	6.4E-03
WDF2	-5.3E-02	-5.1E-02	1.2E-01	-5.8E-02	-3.6E-02	-3.6E-02	-3.3E-02	-5.7E-03	-1.5E-02	9.5E-03	-1.1E-01
DM2	1.6E-02	3.0E-03	3.0E-03	1.1E-02	-1.4E-02	1.6E-02	9.9E-03	-1.2E-02	2.6E-03	5.9E-03	-2.9E-03
EDW2	-1.3E-02	1.2E-02	-4.1E-03	-1.4E-02	1.9E-02	-1.6E-02	7.3E-03	1.5E-02	2.3E-04	-9.0E-04	1.0E-02
DA2	2.3E-03	7.2E-03	5.9E-03	7.2E-03	-3.2E-03	6.3E-03	3.0E-03	-3.7E-03	-1.0E-02	-4.6E-03	-8.1E-04
DE2	-3.6E-03	-6.3E-03	-6.7E-03	8.6E-03	2.0E-02	1.6E-03	1.2E-02	1.4E-02	-6.1E-03	-2.3E-03	2.5E-03
DF2	1.0E-02	2.5E-03	9.3E-03	4.9E-03	-2.2E-03	-3.1E-04	-1.3E-02	2.3E-04	5.6E-03	2.9E-03	-7.6E-03
DQ2	-2.6E-03	3.6E-03	-8.2E-03	-2.6E-03	-2.9E-03	6.8E-03	2.5E-02	4.8E-03	8.0E-03	-5.8E-03	2.7E-03
DMB	1.6E-02	3.2E-03	3.4E-03	1.1E-02	-1.4E-02	1.7E-02	1.0E-02	-1.2E-02	2.8E-03	5.8E-03	-2.9E-03
EDMB	1.2E-02	1.2E-02	-5.4E-03	-1.3E-03	6.4E-03	-8.8E-03	1.3E-02	2.3E-03	1.5E-02	1.2E-02	9.2E-03
DAB	1.3E-03	7.0E-03	6.2E-03	6.9E-03	-3.2E-03	6.5E-03	3.0E-03	-3.2E-03	-1.1E-02	-4.7E-03	-6.3E-04
DEB	6.2E-03	-1.9E-02	-6.5E-03	1.4E-02	2.2E-03	2.0E-02	6.9E-03	1.3E-03	-5.9E-03	5.3E-04	-7.8E-03
DFB	1.2E-02	-7.7E-05	1.2E-02	7.4E-03	-6.8E-04	-4.5E-03	-2.6E-02	-3.1E-03	2.4E-03	5.3E-03	-8.5E-03
DQB	2.2E-03	4.2E-03	-3.2E-03	-1.6E-03	-1.6E-03	4.9E-03	1.6E-02	4.7E-03	9.2E-03	-2.1E-03	-5.8E-04
2K2_2	-7.6E-03	8.6E-02	2.2E-03	1.7E-01	-5.6E-02	1.3E-01	-9.8E-02	-4.9E-02	1.4E-01	3.1E-02	2.0E-01
GM2	4.0E-03	4.0E-03	-9.2E-03	5.2E-03	-6.2E-03	-1.6E-02	-6.2E-02	5.2E-02	-5.5E-03	3.1E-03	9.3E-03
J202	-2.3E-01	3.3E-01	1.7E-01	7.7E-02	4.6E-02	7.3E-02	-3.1E-02	3.2E-01	-7.1E-02	1.3E-02	6.3E-02
C20201	-4.4E-01	5.8E-02	-4.7E-02	-1.9E-01	-2.3E-01	-1.4E-01	6.3E-02	1.9E-02	-1.2E-01	-1.5E-01	-1.9E-02
S20201	-2.4E-01	1.4E-01	4.8E-02	9.2E-02	-4.2E-01	-1.4E-01	-2.1E-02	-6.5E-02	-7.3E-02	-1.8E-01	-1.6E-01
C20202	-3.7E-03	2.1E-01	-8.9E-02	-3.3E-01	-1.7E-01	-3.5E-01	2.0E-01	-3.4E-03	-9.8E-03	-1.2E-01	6.7E-02
S20202	-3.9E-02	1.5E-01	3.1E-01	1.2E-01	-1.7E-01	2.5E-01	-2.7E-01	-2.4E-02	8.1E-02	-5.6E-02	1.3E-01
J203	1.0	-4.3E-02	1.4E-01	1.6E-01	2.0E-01	-9.3E-02	-2.0E-02	-1.7E-01	6.3E-01	4.2E-01	6.9E-02
C20301	1.0	6.4E-02	-5.3E-02	-5.3E-02	-9.8E-02	-9.3E-02	4.0E-02	-3.0E-01	-1.4E-01	-5.2E-02	-1.9E-01
S20301	1.0	1.0	2.8E-01	6.4E-02	5.2E-02	1.4E-01	1.5E-04	-1.1E-01	9.3E-02	-1.4E-01	1.2E-01
C20302	1.0	-2.6E-02	-2.6E-02	-2.6E-02	-2.6E-02	1.3E-01	-2.5E-01	4.6E-02	1.5E-01	7.8E-02	-1.4E-02
S20302	1.0	1.0	1.0	1.0	1.0	4.1E-01	6.7E-02	6.0E-02	5.0E-02	3.3E-01	1.8E-01
C20303	1.0	1.0	1.0	1.0	1.0	4.1E-01	2.7E-02	4.2E-02	1.1E-02	1.4E-01	1.5E-01
S20303	1.0	1.0	1.0	1.0	1.0	4.1E-01	2.7E-02	4.2E-02	1.1E-02	1.4E-01	1.5E-01
J204	1.0	1.0	1.0	1.0	1.0	4.1E-01	2.7E-02	4.2E-02	1.1E-02	1.4E-01	1.5E-01
C20401	1.0	1.0	1.0	1.0	1.0	4.1E-01	2.7E-02	4.2E-02	1.1E-02	1.4E-01	1.5E-01
S20401	1.0	1.0	1.0	1.0	1.0	4.1E-01	2.7E-02	4.2E-02	1.1E-02	1.4E-01	1.5E-01
C20402	1.0	1.0	1.0	1.0	1.0	4.1E-01	2.7E-02	4.2E-02	1.1E-02	1.4E-01	1.5E-02

	S20402	C20403	S20403	C20404	S20404	J205	C20501	S20501	C20502	S20502	C20503
ZACFL2	-4.3E-02	-5.2E-03	-6.5E-04	1.2E-01	2.5E-02	-2.1E-02	6.5E-03	-3.9E-02	-3.3E-02	-4.2E-02	1.3E-01
ZDEF12	-4.7E-02	3.4E-02	-1.2E-04	-1.7E-02	7.8E-03	3.4E-02	-7.7E-03	-4.9E-02	3.1E-02	-3.3E-02	7.5E-02
WDF2	-5.1E-02	1.0E-02	-4.5E-02	-8.9E-02	5.4E-02	-3.0E-02	-4.5E-02	-9.7E-02	9.0E-02	-4.3E-02	-7.4E-03
IMW2	4.3E-03	-8.4E-03	1.7E-02	-9.5E-03	2.2E-02	1.4E-02	-2.1E-03	2.5E-03	1.0E-02	-8.2E-03	1.3E-02
EDW2	-6.6E-03	-6.0E-03	-8.8E-03	4.2E-03	-1.4E-02	-1.4E-02	1.3E-02	-5.4E-03	-1.5E-02	1.3E-02	-1.9E-02
DN2	-6.9E-04	-2.1E-04	3.8E-03	-6.2E-03	4.4E-03	1.3E-02	2.4E-03	1.1E-03	1.4E-02	1.9E-04	2.1E-04
IE2	-2.1E-03	-7.2E-03	-3.4E-02	-4.7E-03	-6.5E-03	6.4E-04	3.3E-03	-8.2E-04	1.5E-02	9.1E-03	-1.2E-02
IF2	-9.2E-04	-4.1E-04	1.2E-03	-4.8E-04	-7.2E-03	-2.5E-04	1.9E-03	3.2E-03	2.6E-03	-4.7E-03	-3.5E-03
DQ2	-6.9E-03	-3.8E-04	-3.3E-03	-1.1E-02	1.8E-02	-1.2E-02	2.3E-03	1.2E-02	-5.4E-03	-1.9E-04	5.2E-03
IMWB	4.1E-03	-7.8E-03	1.6E-02	-9.7E-03	2.2E-02	1.4E-02	-1.6E-03	2.7E-03	1.0E-02	-8.4E-03	1.3E-02
EDWB	-3.6E-03	-2.5E-02	-5.1E-03	1.5E-03	1.8E-02	-2.8E-03	9.5E-03	-2.9E-03	-1.0E-02	-2.4E-03	-1.2E-02
DNB	-5.6E-04	6.1E-04	3.1E-03	-5.9E-03	4.0E-03	1.3E-02	2.7E-03	1.7E-03	1.4E-02	4.7E-04	-5.0E-05
IEB	8.3E-03	7.2E-03	-1.5E-02	-1.3E-02	-1.7E-03	8.0E-03	-8.1E-03	8.1E-04	2.6E-02	-1.0E-03	1.4E-02
IFB	2.6E-03	-8.0E-04	2.7E-03	4.7E-03	-1.5E-02	5.8E-03	-6.4E-04	8.4E-03	4.0E-03	-4.9E-03	-5.4E-03
DQB	-6.1E-03	1.6E-03	-5.1E-03	-8.3E-03	1.0E-02	-1.0E-02	3.5E-03	-8.3E-03	-2.8E-03	-2.8E-03	1.7E-03
2K2_2	7.9E-04	-1.5E-01	-1.3E-01	-2.3E-01	3.1E-01	-3.7E-02	-3.4E-02	-5.9E-02	-2.1E-02	-6.5E-02	-9.2E-02
GM2	4.6E-03	-2.2E-02	-8.2E-03	1.8E-02	-2.0E-02	1.2E-02	1.7E-02	1.0E-02	7.2E-03	-9.7E-03	-8.9E-03
J202	-2.2E-01	1.4E-02	-1.3E-01	2.0E-03	-1.3E-02	6.4E-02	2.9E-01	-2.2E-02	7.0E-02	4.1E-04	-1.3E-01
C20201	5.9E-02	1.8E-01	2.7E-02	1.2E-01	1.6E-01	-1.0E-01	-1.7E-02	-3.8E-02	-1.1E-01	5.6E-02	-8.8E-02
S20201	1.1E-01	-9.3E-02	1.1E-01	9.4E-03	7.3E-02	-3.8E-02	1.6E-02	7.0E-03	-2.0E-02	-5.0E-03	-3.8E-02
C20202	-9.9E-02	2.0E-01	2.4E-01	1.9E-01	-7.6E-02	-2.9E-02	1.2E-01	-6.0E-02	-2.1E-01	-1.6E-02	2.7E-02
S20202	3.6E-02	-1.9E-01	-9.3E-02	3.3E-02	8.1E-02	-2.7E-02	6.0E-02	1.1E-01	-5.9E-02	-1.2E-01	-6.1E-02
J203	-8.6E-02	-4.2E-02	1.1E-02	-8.1E-02	1.1E-02	-1.2E-01	-4.7E-02	3.8E-02	3.2E-02	-3.1E-01	4.8E-02
C20301	-2.6E-01	-1.1E-02	1.3E-02	2.7E-02	9.0E-02	-7.5E-02	3.0E-01	-1.6E-01	-1.2E-01	-8.4E-02	-6.9E-02
S20301	-4.4E-01	4.5E-02	-8.5E-02	-1.8E-03	3.1E-02	-9.5E-03	1.6E-01	1.9E-01	9.9E-03	6.7E-02	-1.5E-01
C20302	-1.5E-01	4.5E-01	-1.7E-01	-7.9E-02	1.1E-01	1.2E-01	-3.2E-02	4.1E-02	2.6E-01	-1.8E-01	1.3E-01
S20302	-9.4E-02	1.4E-01	-4.1E-01	-1.5E-01	-1.7E-01	1.6E-02	5.5E-02	-6.6E-02	1.0E-01	2.0E-01	1.5E-02
C20303	6.7E-03	-8.1E-02	-4.5E-01	-3.9E-01	-3.9E-02	3.0E-02	2.7E-04	9.6E-03	9.2E-02	3.0E-02	2.9E-01
S20303	-2.5E-02	3.5E-01	-6.5E-02	-9.9E-02	-2.4E-01	-2.4E-02	8.8E-02	-2.9E-02	-5.7E-02	7.6E-02	6.8E-02
J204	1.3E-01	2.2E-02	-6.5E-02	-3.4E-02	-1.1E-01	1.3E-01	5.1E-01	3.5E-01	1.1E-01	5.4E-02	-6.4E-02
C20401	-8.8E-02	-5.6E-02	1.3E-02	-3.4E-02	9.9E-02	-5.4E-01	-1.5E-01	-6.6E-02	-4.4E-01	-3.7E-01	-2.5E-02
S20401	2.5E-02	1.0E-02	-1.1E-01	-8.2E-02	-2.5E-02	-2.3E-01	4.2E-02	-2.3E-01	1.6E-01	-5.3E-01	8.3E-02
C20402	-8.6E-02	5.5E-02	-9.3E-03	-2.1E-02	6.2E-02	6.9E-02	7.0E-02	1.1E-01	-2.7E-01	1.7E-02	-3.6E-01
S20402	1.0	1.8E-02	-1.3E-01	-3.6E-02	-5.2E-02	-8.0E-02	-9.9E-02	1.1E-01	1.4E-02	-1.2E-01	1.4E-02
C20403	1.0	1.0	7.6E-03	-5.3E-03	-2.5E-01	-4.5E-02	8.6E-02	-1.4E-02	-3.0E-02	1.8E-01	-1.2E-01
S20403			1.0	3.4E-01	9.1E-02	-3.0E-02	-2.5E-02	3.5E-02	-1.2E-01	2.5E-02	3.1E-02
C20404				1.0	-6.0E-02	-3.6E-03	-3.0E-02	2.7E-02	-6.5E-02	6.9E-02	-2.7E-03
J205					1.0	-3.6E-03	8.0E-02	1.1E-01	-2.3E-01	9.2E-02	-1.4E-02
C20501						1.0	1.0	2.7E-01	1.1E-01	1.8E-02	-9.7E-02
S20501								1.0	3.6E-02	1.5E-01	-4.8E-02
C20502									1.0	1.9E-02	1.7E-01
S20502										1.0	1.4E-02
C20503											1.0



	S20503	C20504	S20504	C20505	S20505
ZACFL2	-3.5E-02	2.0E-02	-3.1E-02	-2.8E-02	-5.8E-02
ZDEF12	-4.1E-02	-6.3E-03	1.6E-02	1.7E-02	-3.8E-03
WDF2	9.3E-02	-5.0E-02	-3.8E-03	3.4E-02	-2.1E-02
DM2	8.8E-03	1.2E-02	-9.2E-03	-9.1E-03	-9.5E-04
ED2	3.4E-03	-1.3E-02	1.8E-02	9.2E-04	4.0E-03
DA2	5.9E-03	3.3E-04	-7.4E-04	-5.3E-03	-5.4E-04
DE2	-5.3E-03	-1.3E-02	4.0E-02	1.3E-02	1.3E-02
DF2	-2.0E-03	2.1E-03	-3.4E-03	3.0E-03	1.5E-04
DQ2	7.4E-03	9.6E-03	1.8E-02	-1.1E-02	1.6E-02
DWB	9.0E-03	1.2E-02	-8.5E-03	-9.2E-03	1.4E-04
EDB	5.3E-03	-5.4E-03	2.6E-02	2.3E-03	1.7E-03
DAB	5.8E-03	-1.3E-04	-6.9E-04	-5.1E-03	1.9E-05
DEB	-5.9E-03	4.5E-03	7.7E-03	4.2E-03	9.8E-03
DFB	-5.8E-03	-2.6E-03	-1.3E-02	8.5E-03	-9.0E-03
DOB	5.5E-03	7.2E-03	1.6E-02	-7.6E-03	1.4E-02
2K2_2	-8.8E-02	1.9E-01	9.4E-02	1.4E-01	-3.3E-03
GM2	-2.3E-02	3.2E-02	5.7E-03	2.0E-02	-6.0E-02
J202	1.0E-01	-2.3E-02	6.3E-02	6.8E-02	7.7E-02
C20201	-7.8E-03	-2.3E-02	-4.6E-02	-2.8E-02	4.6E-02
S20201	6.7E-02	2.1E-02	1.6E-02	-1.9E-02	8.5E-02
C20202	1.6E-01	-8.7E-02	-1.8E-01	-2.0E-01	-4.7E-02
S20202	-6.5E-02	4.2E-02	7.1E-02	7.7E-02	8.4E-02
J203	1.3E-02	8.4E-02	-1.3E-02	4.8E-04	-7.3E-02
C20301	2.7E-01	-1.2E-02	-4.4E-02	-1.9E-03	3.0E-02
S20301	1.3E-01	-2.1E-02	-4.5E-02	1.2E-01	4.9E-02
C20302	-9.9E-03	2.5E-01	6.7E-02	9.0E-02	-1.1E-01
S20302	-3.3E-02	-1.1E-01	1.6E-01	1.3E-01	-5.5E-02
C20303	-1.5E-02	5.2E-02	3.5E-01	2.8E-01	1.3E-02
S20303	4.2E-01	-2.8E-01	4.4E-02	-2.8E-01	3.3E-01
J204	-2.1E-02	-6.5E-02	6.3E-02	2.8E-02	5.6E-02
C20401	-7.1E-03	4.8E-02	-3.9E-02	2.3E-02	-6.6E-03
S20401	3.5E-02	4.4E-02	9.5E-02	5.5E-02	-1.1E-02
C20402	-1.1E-01	1.7E-02	7.8E-03	8.3E-02	-2.5E-02
S20402	-4.1E-01	-3.6E-02	5.1E-02	-2.3E-02	2.3E-02
C20403	3.2E-03	-5.0E-01	-2.7E-02	-1.5E-01	2.0E-01
S20403	-4.3E-02	-6.3E-02	-4.7E-01	-3.3E-01	-4.8E-02
C20404	-5.8E-02	-1.0E-01	-4.4E-01	-3.1E-01	-1.6E-01
S20404	-1.1E-01	4.0E-01	-1.0E-01	-2.8E-02	-3.3E-01
J205	4.0E-03	5.5E-02	-1.2E-02	2.1E-02	-4.5E-02
C20501	1.3E-01	-7.8E-02	1.4E-02	-4.3E-03	4.2E-02
S20501	-9.8E-02	3.9E-02	-7.5E-02	2.0E-02	-1.9E-02
C20502	1.6E-02	4.2E-02	1.3E-01	3.6E-02	-4.9E-02
S20502	1.2E-02	-1.3E-01	1.5E-03	3.3E-03	-1.3E-02
C20503	2.0E-02	1.2E-01	2.9E-02	4.2E-02	-1.2E-01
S20503	1.0	-4.3E-02	7.0E-02	-1.1E-01	2.0E-01
C20504		1.0	1.2E-03	1.6E-01	-3.7E-01
S20504			1.0	3.0E-01	1.4E-01
C20505				1.0	-7.2E-02
S20505					1.0



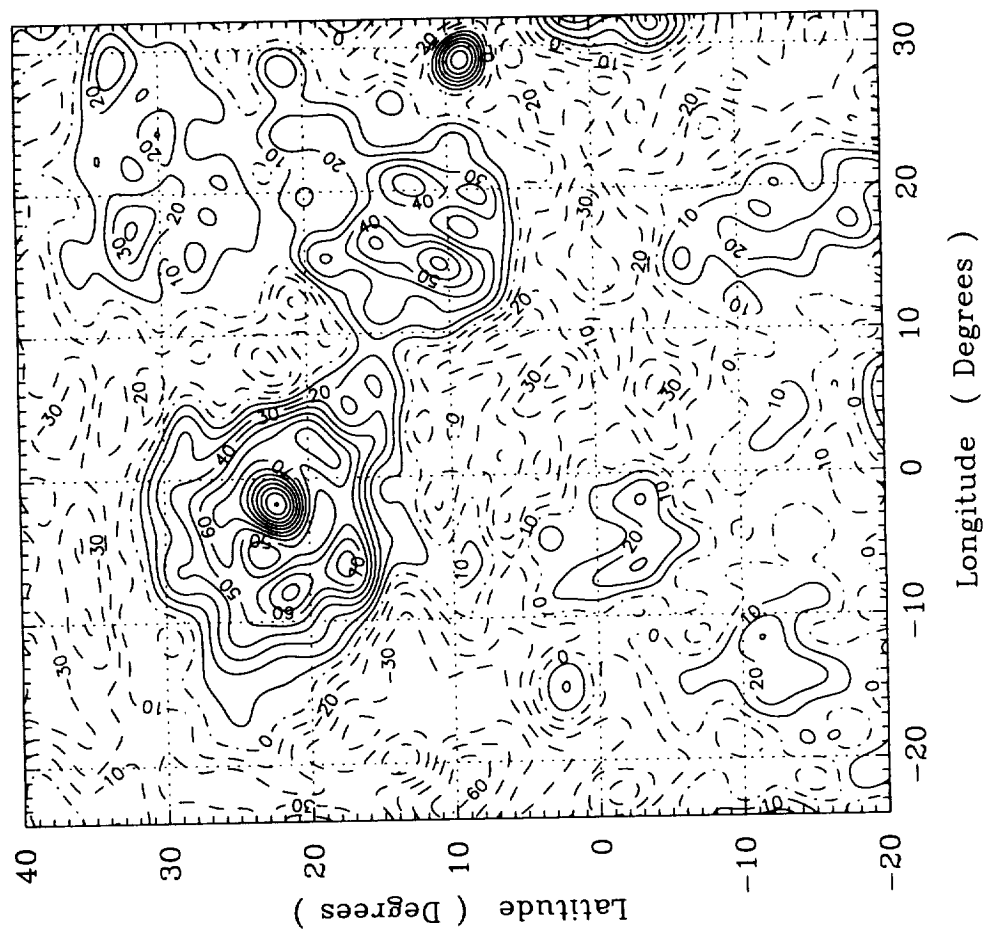
# **Appendix I**

## **Regional Gravity Maps for MGNP90LSAAP**

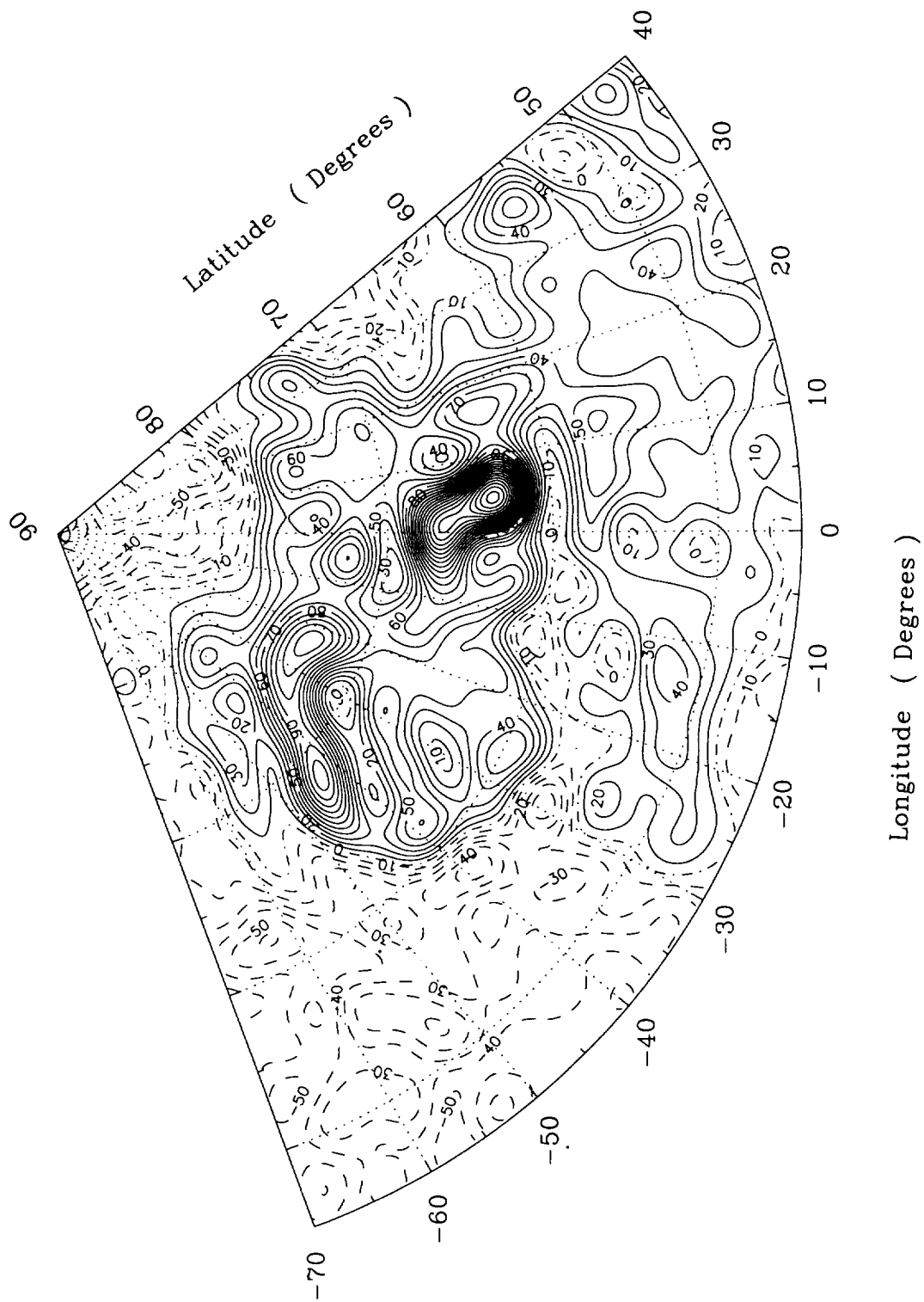
The following vertical gravity plots in milligal contours are included in this appendix:

1. Eistla Regio
2. Ishtar Terra
3. Bell Regio
4. Beta Regio
5. Atla Regio
6. Aphrodite Terra
7. Atalanta Planitia

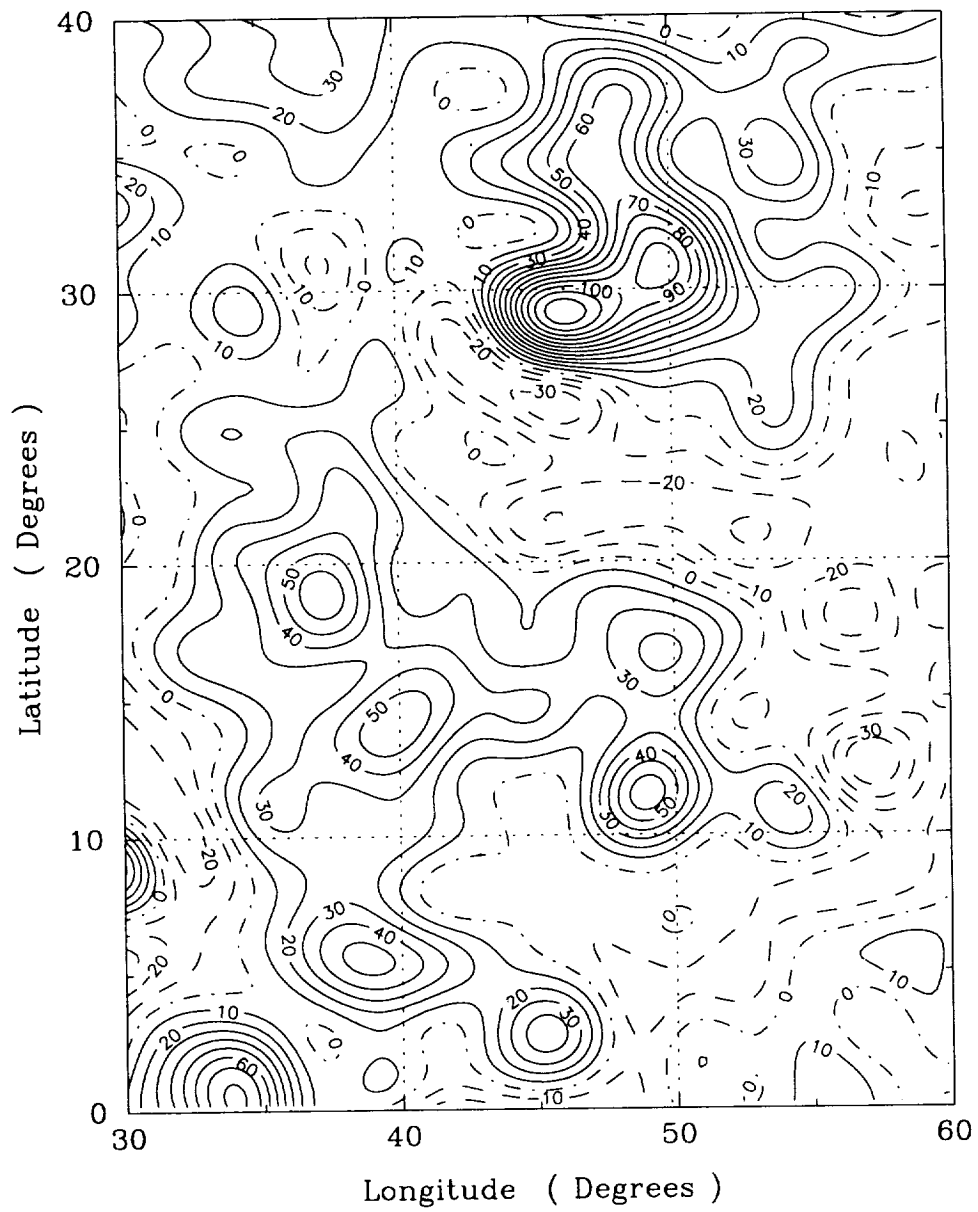
Eistla Regio

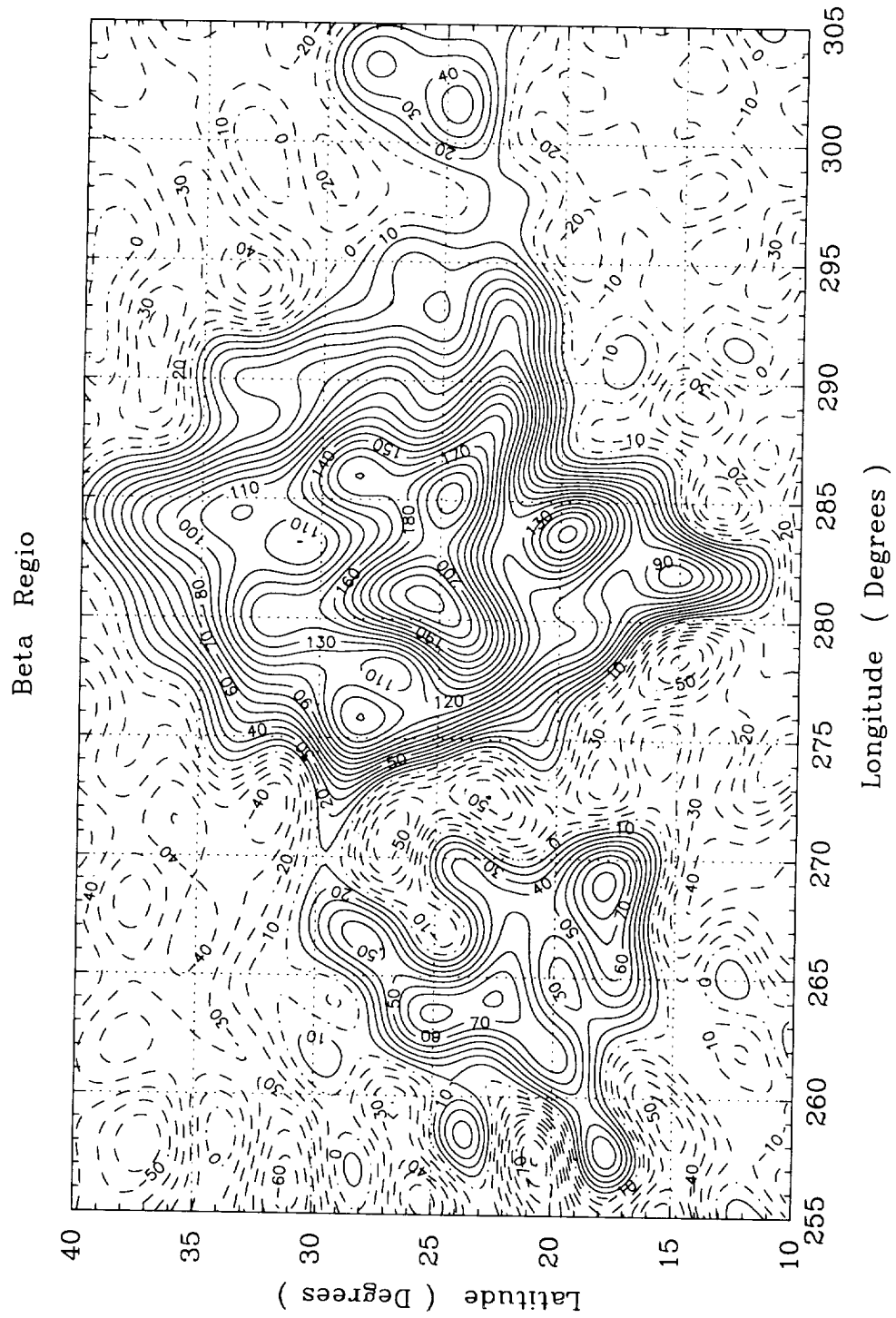


Ishtar Terra

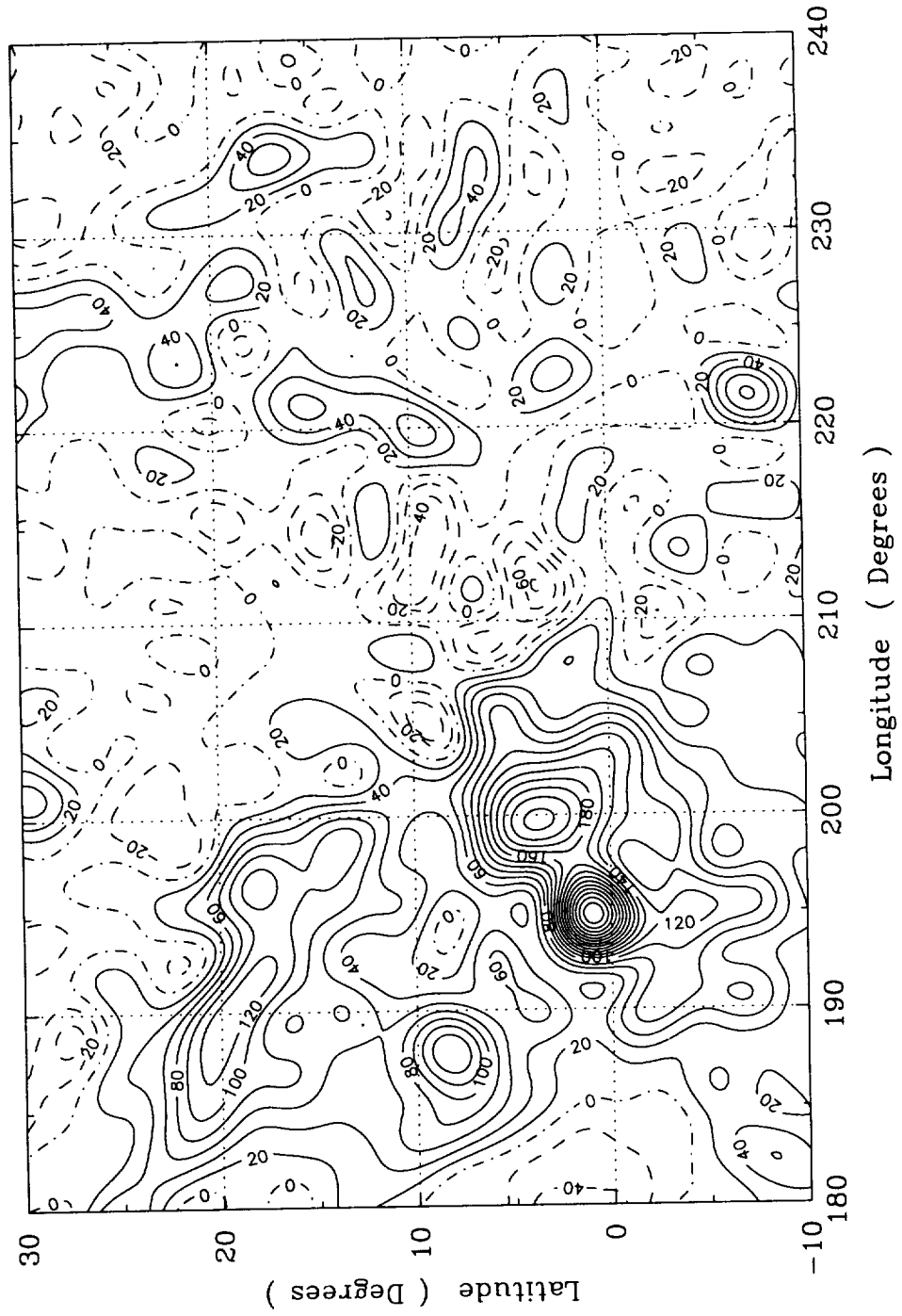


# Bell Regio



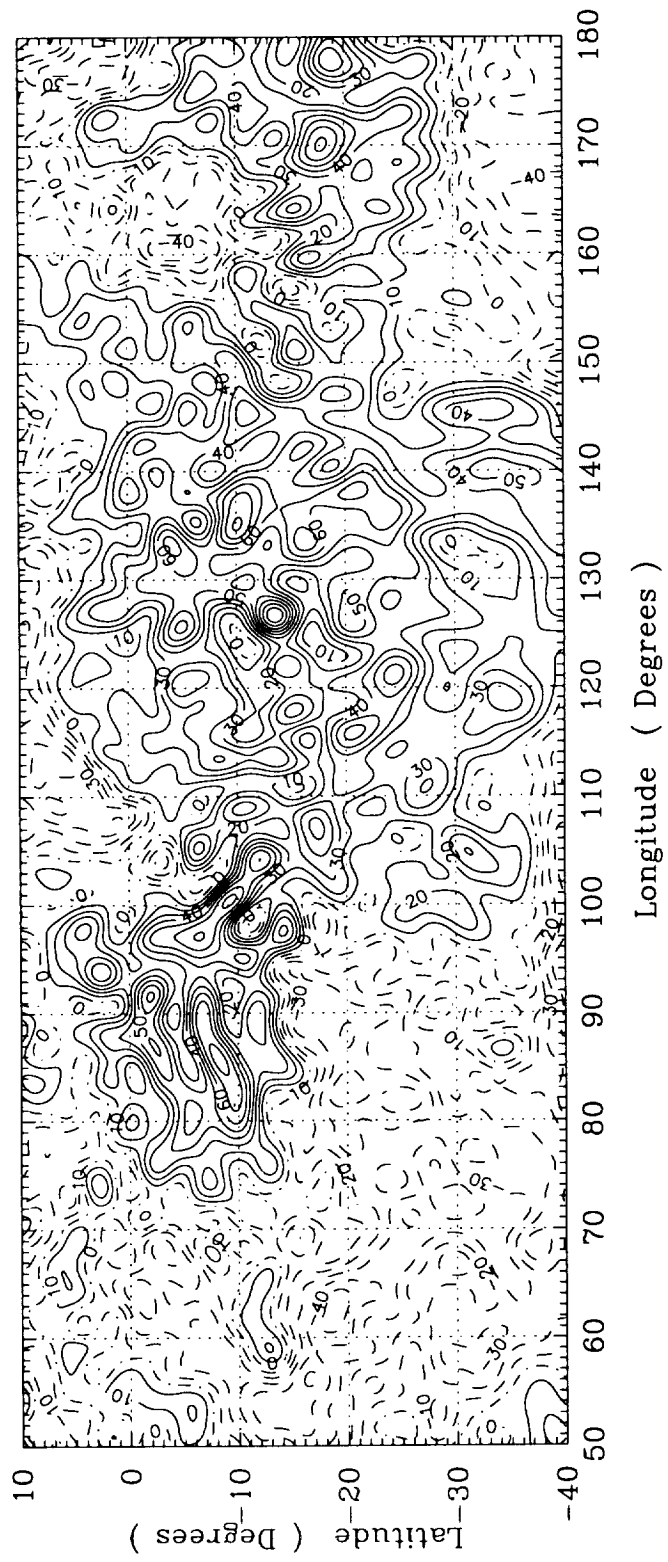


Atla Regio





Aphrodite Terra



# Atalanta Planitia

